2024

友思特
激光器配件系列

产品手册

Viewsitec
友思特

Beam
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激光器配件

光束传输装置

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Compact motorized laser beam expanders MEX

High-power motorized beam expanders MEX-HP

Vertical motorized laser beam expander MEX-V

Variable beam expanders VEX and reducers VRE

Fixed ratio laser beam expanders FEX

Motorized laser power attenuators LPA

Manual laser power attenuators LPA-M

Unpolarized beam motorized laser power attenuator LPA-U

Flat top converter FTC

Motorized polarization rotator MRO

紧凑型电动激光扩束器 MEX

主要特点

- 最高的光束指向稳定性（< 0.3 mrad）
- 一体化设计，集成控制器
- 两个镜头同步智能移动，确保无误焦
- 绝对编码器（两个镜头）
- 调整时间 <1 s（所有放大倍率）
- 熔融石英光学元件
- 打开/关闭后无需归位
- 所有放大倍数具有衍射极限性能

应用案例

- 工业激光微加工
- 生命科学
- 研究

MEX-V2系列电动激光扩束器用于增加激光束直径和调节发散角。标准或定制光束扩展器采用独特的机械闭环滑动透镜设计，确保高指向稳定性和最小尺寸。改进的镜头移动速度和指向稳定性确保了更好的控制质量。这些可变放大（变焦）光束扩展器和减速器是专为所需波长而设计的，我们的每种类型的光束扩展器都具有电动发散角调节功能。

参数	
调整方式	自动
发散角	可调
输入孔径	11,5 mm
透射率	>97%
光学元件数量	3 (MEX13, MEX18), 4 (MEX18-ACH)
镜片材质	UVFS
控制接口	USB or RS232
外壳材料	黑色阳极氧化铝
LIDT	3 J/cm² (10 ns @ 355 nm) 5 J/cm² (10 ns @ 532 nm) 10 J/cm² (10 ns @ 1064 nm)

*提供定制设计

标准产品

型号	放大倍数	输入通光孔径	输出通光孔径	推荐最大输出通光直径 (1/E2)	尺寸 (H X W X L)	设计波长	指向稳定性	货号编码
MEX13	1.0x - 3.0x continuous	11,5 mm	23 mm	ø7 mm (1x) - ø6 mm (3x)	45 x 45 x 140 mm	1030-1064 nm	<0,5 mrad	6825
						515-532 nm		6833
						343-355 nm		6838
						1030-1064 + 515-532 nm		6836
						515-532 + 343-355 nm		6131
						760-840 nm		31223
						390-410 nm		31224
						400 + 800 nm		31225
						1030-1064 nm	<0,2 mrad	6855
						515-532 nm		6856
						343-355 nm		6857
						1030-1064 + 515-532 nm		6927
						515-532 + 343-355 nm		6928
						760-840 nm		31226
						390-410 nm		31227
						400 + 800 nm		31228
MEX18	1.0x - 8.0x continuous	11,5 mm	38 mm	ø7 mm (1x) - ø5mm (5x) mm - ø3 mm (8x)	45 x 45 x 237 mm	1030-1064 nm	<0,5 mrad	6841
						515-532 nm		6842
						343-355 nm		6121
						1030-1064 + 515-532 nm		6843
						515-532 + 343-355 nm		6844
						760-840 nm		31229
						390-410 nm		31230
						400 + 800 nm		31231
						1030-1064 nm	<0,2 mrad	31232
						515-532 nm		31233
						343-355 nm		31234
						1030-1064 + 515-532 nm		31235
						515-532 + 343-355 nm		31236
						760-840 nm		31237
						390-410 nm		31238
						400 + 800 nm		31239
MEX18-ACH	1.0x - 8.0x continuous	11,5 mm	38 mm	ø7 mm (1x) - ø5mm (5x) mm - ø3 mm (8x)	45 x 45 x 237 mm	300-750 nm	<0,5 mrad	9235

电动扩束器MEX的安装附件选项

安装选项	光束高度	货号编码
手动 4 轴平移台 M-STAGE	27 mm (±2 mm travel)	12571

新型紧凑型电动激光扩束器MEX-V2

主要性能

- 最高波束指向稳定性（<0,1 mrad）
- 一体化设计，集成控制器
- 两个镜头同步智能移动，确保不会出现失焦
- 绝对编码器（两个镜头）
- 调整时间<0.7秒（所有放大倍数）
- 熔融二氧化硅光学元件
- 打开/关闭后无需归位
- 所有放大倍数具有衍射极限性能
- 远程控制改变聚焦光束光斑大小及其在Z轴上的位置

新版更新：

- 镜头移动速度快30%，更稳定（< 0.7秒）
- 针对全天连续工作使用情况进行了优化
- 更优的指向稳定性<0.1 mrad或<0.3 mrad
- 重新设计的具有反极性和过电流保护的控制器

应用案例

- 全天候工业激光微加工
- 生命科学
- 科研

MEX-V2系列电动激光扩束器用于增加激光束直径和调节发散角。标准或定制光束扩展器采用独特的机械闭环滑动透镜设计，确保高指向稳定性和最小尺寸。改进的镜头移动速度和指向稳定性确保了更好的控制质量。这些可变放大（变焦）光束扩展器和减速器是专为所需波长而设计的，我们的每种类型的光束扩展器都具有电动发散角调节功能。

产品包装包含

- 电动激光扩束器MEX-V2
- 带软件和手册的USB工具
- 电源DC 12V
- USB（1.5米）线缆

标准产品

产品 型号	扩束倍率	通光输入 孔径	通光输出 孔径	建议的最大 输入光束直径（1/E2）	尺寸 (H X W X L)	设计 波长	指向 稳定性	货号编码
MEX13-V2	1.0x - 3.0x continuous	11,5 mm	23 mm	ø7 mm (1x) - ø6 mm (3x)	45 x 45 x 140 mm	1030-1064 nm	<0,3 mrad	29283
						515-532 nm		29284
						343-355 nm		29285
						1030-1064 + 515-532 nm		29286
						515-532 + 343-355 nm		29287
						760-840 nm		31274
						390-410 nm		31275
						400 + 800 nm		31276
						1030-1064 nm	<0,1 mrad	29288
						515-532 nm		29289
						343-355 nm		29290
						1030-1064 + 515-532 nm		29291
						515-532 + 343-355 nm		29292
						760-840 nm		31277
						390-410 nm		31278
						400 + 800 nm		31279
MEX18-V2	1.0x - 8.0x continuous	11,5 mm	38 mm	ø7 mm (1x) - ø5mm (5x) mm - ø3 mm (8x)	45 x 45 x 237 mm	1030-1064 nm	<0,3 mrad	29293
						515-532 nm		29294
						343-355 nm		29295
						1030-1064 + 515-532 nm		29297
						515-532 + 343-355 nm		29298
						760-840 nm		31280
						390-410 nm		31281
						400 + 800 nm		31282
						1030-1064 nm	<0,1 mrad	31284
						515-532 nm		31285
						343-355 nm		31286
						1030-1064 + 515-532 nm		31287
						515-532 + 343-355 nm		31288
						760-840 nm		31289
						390-410 nm		31290
						400 + 800 nm		31291
MEX18-ACH-V2	1.0x - 8.0x continuous	11,5 mm	38 mm	ø7 mm (1x) - ø5mm (5x) mm - ø3 mm (8x)	45 x 45 x 237 mm	350-800 nm	<0,3 mrad	31283

电动扩束器MEX的安装附件选项

MOUNTING OPTION	FOR BEAM HEIGHT OF	货号编码
Manual 4 axis translation stage M-STAGE	27 mm (±2 mm travel)	12571

高功率电动扩束器 MEX-HP

主要特点

- 高功率光学设计（高达 200 W @ 1030 nm、500 fs、1 MHz）
- 光学元件无内反射
- 最高光束指向稳定性 < 0.2 mrad
- 具有集成控制器的一体化设计
- 两镜头同时移动，确保无误焦
- 绝对编码器（两个镜头）
- 熔融石英光学元件
- 所有放大倍数具有衍射极限性能

应用

- 精准激光微加工
- 高功率激光束控制
- 科研

高功率电动激光扩束镜MEX系列用于增加激光束直径和调节发散度。该光学设计专用于高功率超快飞秒激光应用。这些放大（变焦）扩束器专为所需波长而设计，每种类型的扩束器都具有电动发散可调性。标准或定制扩束镜采用独特的机械闭环滑动透镜设计，确保高指向稳定性和最小尺寸。

参数	
调整方式	自动
发散角	可调
镜片材质	UVFS
透射率	>97% (MEX13-HP), >95% (MEX15-HP)
控制接口	USB or RS232
控制器	Integrated
外壳材质	Black anodized aluminum
最大激光功率	Up to 200 W @ 1030 nm, 500 fs, 1 MHz
LIDT	3 J/cm² (10 ns @ 355nm) 5 J/cm² (10 ns @ 532 nm) 10 J/cm² (10 ns @ 1064 nm)

*提供定制设计

标准产品

型号	放大倍数	通光输入孔径	通光输出孔径	建议最大输入光束直径 (1/E2)	尺寸 (H X W X L)	设计波长	指向稳定性	货号编码
MEX13-HP	1.0x - 3.0x continuous	11,5 mm	28 mm	ø7 mm (1x) - ø6 mm (3x)	60 x 60 x 207 mm	1030-1064 nm	<0,5 mrad	9238
						515-532 nm		9240
						343-355 nm		9242
						1030-1064 + 515-532 nm		9244
						515-532 + 343-355 nm		9246
						257-266 nm		31243
						760-840 nm		31240
						390-410 nm		31241
						400 + 800 nm		31242
						1030-1064 nm	<0,2 mrad	9239
						515-532 nm		9241
						343-355 nm		9243
						1030-1064 + 515-532 nm		9245
						515-532 + 343-355 nm		9247
						257-266 nm		31244
						760-840 nm		31245
						390-410 nm		31246
						400 + 800 nm		31247
MEX15-HP	1.0x - 5.0x continuous	11,5 mm	24 mm	ø7 mm (1x) - ø3,3 mm (5x)	65 x 65 x 250 mm	1030-1064 nm	<0,5 mrad	9248
						515-532 nm		9250
						343-355 nm		9252
						1030-1064 + 515-532 nm		9254
						515-532 + 343-355 nm		9256
						257-266 nm		31251
						760-840 nm		31248
						390-410 nm		31249
						400 + 800 nm		31250
						1030-1064 nm	<0,2 mrad	22062
						515-532 nm		22063
						343-355 nm		22064
						1030-1064 + 515-532 nm		22065
						515-532 + 343-355 nm		22066
						257-266 nm		31252
						760-840 nm		31253
						390-410 nm		31254
						400 + 800 nm		31255

高功率电动扩束器MEX-HP的安装附件选项

安装选项	光束高度	货号编码
Manual 4 axis translation stage M-STAGE-W	27 mm (±2 mm travel)	29135

高功率电动扩束器
MEX-HP-V2

主要特点

- 高功率光学设计（高达 200 W @ 1030 nm、500 fs、1 Mhz）
- 光学元件无内反射
- 具有集成控制器的一体化设计
- 两镜头同时移动，确保不失焦
- 绝对编码器（两个镜头）
- 熔融石英光学元件
- 调整时间 <0.7 s（所有放大倍率）
- 所有放大倍数具有衍射极限性能
- 远程控制改变聚焦光束光斑大小及其在Z轴上的位置

新版更新

- 镜头移动速度快30%，更稳定（< 0.7s）
- 针对全天连续工作使用情况进行了优化
- 更优的指向稳定性<0.1 mrad或<0.3 mrad
- 重新设计的具有反极性和过电流保护的控制器

应用案例

- 全天候工业激光微加工
- 精密激光微加工
- 高功率激光光束控制
- 科研

高功率电动激光扩束镜MEX-HP-V2系列用于增加激光束直径并调节发散度。 该光学设计专用于高功率超快飞秒激光应用。 改进的镜头移动速度和指向稳定性确保更好的控制质量。 这些放大（变焦）扩束器专为所需波长而设计，我们的每种类型的扩束器都具有电动发散可调性。 标准或定制扩束镜采用独特的机械闭环滑动透镜设计，确保高指向稳定性和最小尺寸。

产品包括：

- 电动激光扩束镜MEX-HP
- 带有软件和手册的 USB 盘
- 电源 DC 12V
- USB (1.5 m) 线缆

标准产品

型号	放大倍数	通光输入孔径	通光输出孔径	建议最大输入光束直径 (1/E2)	尺寸 (H X W X L)	设计波长	指向稳定性	货号编码
MEX13-HP-V2	1.0x - 3.0x continuous	11,5 mm	28 mm	ø7 mm (1x) - ø6 mm (3x)	60 x 60 x 207 mm	1030-1064 nm	<0,5 mrad	31007
						515-532 nm		31011
						343-355 nm		31015
						1030-1064 + 515-532 nm		31009
						515-532 + 343-355 nm		31013
						257-266 nm		31258
						760-840 nm		31259
						390-410 nm		31260
						400 + 800 nm		31261
						1030-1064 nm	<0,2 mrad	31006
						515-532 nm		31010
						343-355 nm		31014
						1030-1064 + 515-532 nm		31008
						515-532 + 343-355 nm		31012
						257-266 nm		31262
						760-840 nm		31263
						390-410 nm		31264
						400 + 800 nm		31265
MEX15-HP-V2	1.0x - 5.0x continuous	11,5 mm	24 mm	ø7 mm (1x) - ø3,3 mm (5x)	65 x 65 x 250 mm	1030-1064 nm	<0,5 mrad	31017
						515-532 nm		31021
						343-355 nm		31025
						1030-1064 + 515-532 nm		31019
						515-532 + 343-355 nm		31023
						257-266 nm		31266
						760-840 nm		31267
						390-410 nm		31268
						400 + 800 nm		31269
						1030-1064 nm	<0,2 mrad	31016
						515-532 nm		31020
						343-355 nm		31024
						1030-1064 + 515-532 nm		31018
						515-532 + 343-355 nm		31022
						257-266 nm		31270
						760-840 nm		31271
						390-410 nm		31272
						400 + 800 nm		31273

高功率电动扩束器MEX-HP的安装附件选项

安装选项	光束高度	货号编码
Manual 4 axis translation stage M-STAGE-W	27 mm (±2 mm travel)	29135

立式电动激光扩束器 MEX-V

主要特点

- 高功率光学设计（高达 200 W @ 1030 nm、500 fs、1 Mhz）
- 光学元件无内反射
- 高光束指向稳定性 <0.2 mrad
- 一体化设计，集成控制器
- 两镜头同时移动，确保不失焦
- 绝对编码器（两个镜头）
- 调整时间 <4 s（所有放大倍率）
- 熔融石英光学元件
- 所有放大倍数具有衍射极限性能
- 无安装限制

应用案例

- 精准激光微加工
- 高功率激光光束控制
- 科研

立式电动激光扩束镜MEX-V系列用于增加激光束直径和调节发散度。 该光学设计专用于高功率超快飞秒激光应用。 更慢、更稳定的镜头控制结合了高功率型号的优点和垂直安装的能力以实现更强大的功能。这些放大（变焦）扩束器专为所需波长而设计，我们的每种类型的扩束器都具有电动发散可调性。 标准或定制扩束镜采用独特的机械闭环滑动透镜设计，确保高指向稳定性和最小尺寸。

产品包括

- 电动激光扩束镜MEX-V
- 带有软件和手册的 USB 盘
- 电源 DC 12V
- USB (1.5 m) 线缆

标准产品

型号	放大倍数	通光输入孔径	通光输出孔径	建议最大输入光束直径 (1/E2)	尺寸 (H X W X L)	设计波长	指向稳定性	货号编码
MEX15-V	1.0x - 5.0x continuous	11 mm	24 mm	⌀7 mm (1x) - ⌀3,3 mm (5x)	80 x 80 x 245 mm	1030-1064 nm	<0,5 mrad	31165
						515-532 nm		31167
						343-355 nm		31169
						1030-1064 + 515-532 nm		31166
						515-532 + 343-355 nm		31168
						257-266 nm		31257
						760-840 nm		31170
						390-410 nm		31171
						400 + 800 nm		31172
						1030-1064 nm	<0,2 mrad	31157
						515-532 nm		31159
						343-355 nm		31161
						1030-1064 + 515-532 nm		31158
						515-532 + 343-355 nm		31160
						257-266 nm		31256
						760-840 nm		31162
						390-410 nm		31163
						400 + 800 nm		31164

Variable beam expanders VEX and reducers VRE

Main features

- Highest beam pointing stability (< 0,5 mrad)
- Fused silica optical elements
- Grease free mechanical design
- Sliding lens design
- Diffraction limited performance for all magnifications

Application examples

- Laser micromachining
- Research

Optogama introduces variable manual beam expanders VEX series used to increase or decrease the laser beam diameter. Standard or custom-made laser beam expanders for the UV, visible, and NIR spectral ranges feature a unique mechanical sliding-lens design, ensuring a high pointing stability and minimal dimensions. These variable magnification (zoom) beam expanders are designed for the required wavelength and each type of our beam expanders have divergence adjustability.
All optical elements of beam expanders are made of fused silica with high LIDT coatings and provide stable and reliable performance even when using them with high power lasers. Large input and output apertures allow the optical beam expanders to produce diffraction limited expanded (or reduced) beams for a wide range of input beams.

Standard specifications

VARIABLE BEAM EXPANDERS AND REDUCERS SPECIFICATIONS	
Adjustment	Manual
Divergence	Adjustable
Pointing stability	<0,5 mrad, <1 mrad (VEX15-HP)
Lens material	UVFS
Transmission	>97%, >95% (VEX15-HP)
LIDT	3 J/cm² (10 ns @ 355nm) 5 J/cm² (10 ns @ 532 nm) 10 J/cm² (10 ns @ 1064 nm)

Standard products

ITEM MODEL	EXPANSION	CLEAR INPUT APERTURE	CLEAR OUTPUT APERTURE	DESIGN	RECOMMENDED MAX INPUT BEAM DIAMETER (1/E2)	MOUNTING OPTIONS	DIMENSIONS	WAVELENGTH	SKU
VEX13	1.0x - 3.0x continuous	11 mm	23,5 mm	Standard	ø7 mm (1x) - ø5 mm (3x)	M30x1 external, SM1 internal, ø38.1 mm [1.5"], T-mount (M42x0.75)	ø42 x 110 mm	1030-1064 nm	6985
								515-532 nm	6987
								343-355 nm	4357
								1030-1064 + 515-532 nm	6990
								515-532 + 343-355 nm	6991
VRE13	0.33x - 1.0x continuous	22 mm	11 mm	Standard	ø15 mm (0,33x) - ø7 mm (1x)	M30x1 external, SM1 internal, ø38.1 mm [1.5"], T-mount (M42x0.75)	ø42 x 110 mm	1030-1064 nm	31295
								515-532 nm	6995
								343-355 nm	6997
								1030-1064 + 515-532 nm	6999
								515-532 + 343-355 nm	7000
VEX18	1.0x - 8.0x continuous	11 mm	40 mm	Standard	ø7 mm (1x) - ø5,3 mm (5x) - ø3,3 mm (8x)	SM2, ø50.8 mm [2']	ø53 x 203 mm	1030-1064 nm	6992
								515-532 nm	6725
								343-355 nm	6455
								1030-1064 + 515-532 nm	6994
								515-532 + 343-355 nm	6456
VRE18	0.12x - 1.0x continuous	40 mm	11 mm	Standard	ø26 mm (0,33x) - ø7 mm (1x)	SM2, ø50.8 mm [2']	ø53 x 203 mm	1030-1064 nm	31298
								515-532 nm	31299
								343-355 nm	31300
								1030-1064 + 515-532 nm	31301
								515-532 + 343-355 nm	31302
VEX15-HP	1.0x - 5.0x continuous	11 mm	24 mm	High power	ø7 mm (1x) - ø3,3 mm (5x)	T-mount, SM2, ø50,8 mm [2"]	ø58 x 250 mm	1030-1064 + 515-532 nm	9273
								515-532 + 343-355 nm	9279
								1030-1064 nm	31303
								515-532 nm	31304
								343-355 nm	31305

Mounting options for motorized beam expanders VEX

DESCRIPTION	MOUNTING	WEIGHT	MOUNTING	SKU
VEX13	75 x 28 x 100 mm	500 g	55 mm	29270
VEX18	102 x 28 x 100 mm	500 g	55 mm	29271

Fixed ratio beam expanders FEX

Main features

- Divergence adjustment
- Galilean optical design
- UVFS optical elements
- Grease free mechanical design
- Wide wavelength adoption - 200 nm to 2 µm

Application examples

- Laser material processing
- Medical
- Research

Fixed ratio beam expanders FEX series are used to increase the laser beam diameter. The FEX model diversity covers the UV, visible and NIR spectral ranges. These compact beam expanders are designed for required wavelength and have divergence adjustability. All optical elements of beam expanders are made of fused silica with high LIDT coatings and provide a stable and reliable performance even using them with high power lasers.

Standard specifications

FIXED RATIO BEAM EXPANDER SPECIFICATIONS	
Clear output aperture	23 mm
Divergence	Adjustable
Outer Diameter	30 mm
Mounting options	SM1 (male, female), ø30 mm
Transmission	>98%
LIDT	3 J/cm² (10 ns @ 355nm) 5 J/cm² (10 ns @ 532 nm) 10 J/cm² (10 ns @ 1064 nm)

*Custom design available

Standard products

ITEM MODEL	EXPANSION	CLEAR INPUT APERTURE	RECOMMENDED MAX. INPUT BEAM SIZE, 1/E²	CLEAR OUTPUT APERTURE	MECHANICAL LENGTH	WAVELENGTH	SKU
FEX-2	2 x	11,5 mm	ø7 mm	23 mm	65 mm	343-355 nm	7723
						515-532 nm	7725
						1030-1064 nm	7727
						1030-1064 + 515-532 nm	11169
FEX-3	3 x	11,5 mm	ø5,3 mm	23 mm	65 mm	343-355 nm	7733
						515-532 nm	7731
						1030-1064 nm	7729
						1030-1064 + 515-532 nm	11170
FEX-4	4 x	11,5 mm	ø4 mm	23 mm	90 mm	343-355 nm	7735
						515-532 nm	7737
						1030-1064 nm	7739
						1030-1064 + 515-532 nm	11171
FEX-5	5 x	11,5 mm	ø3,2 mm	23 mm	95 mm	343-355 nm	7741
						515-532 nm	7743
						1030-1064 nm	7746
						1030-1064 + 515-532 nm	11172
FEX-8	8 x	7 mm	ø2 mm	23 mm	104 mm	343-355 nm	7749
						515-532 nm	7752
						1030-1064 nm	7754
						1030-1064 + 515-532 nm	11173

Mounting options for motorized beam expanders FEX

RECOMMENDED ACCESSORY	FOR BEAM HEIGHT OF	SKU
Adapter SM1 male to M30 X 1 male	-	9338
Adapter SM1 female to C-mount	-	9339
Adapter SM1 female to M30 X 1 male	-	9340
X-Y adjustable (3 adjusters) kinematic mount with post holder	50,8 mm (2")	9341
X-Y adjustable (3 adjusters) kinematic mount with post holder	76,2 - 100 mm (3" – 4")	9342

Motorized laser power attenuators LPA

Main features

- Robust design
- Damage threshold up to 10J/cm2 (10 ns @ 1064 nm)
- Adjustable polarizer angle ±2 deg
- Clear aperture 18 mm)
- External controller included
- Intuitive software
- 175,543 steps in full rotation
- ± 0,05 % laser power accuracy
- Adjustment time <0,2 sec (min to max)

Application examples

- Laser machining
- Research
- Laser power control and attenuation

Optogama designs and manufactures motorized laser power attenuators for laser power control. LPA could be produced for use in the UV, visible, and NIR spectral ranges from 250 nm to 2000 nm. These devices feature a large clear aperture dedicated for considerable beam application. All optical elements of these laser power attenuators are made for high LIDT and provide a stable and reliable performance even when using them with high power lasers in industrial applications. Secondary laser beam from the laser power attenuator unit is rejected out through the output window to an external beam dump (optional) in order to avoid any thermal effects or stress in the housing of the LPA device. Exit laser beam has a 2,25 mm beam offset.

Standard specifications

MOTORIZED LASER POWER ATTENUATOR SPECIFICATIONS	
Input and output clear aperture	18 mm
Dimensions (H x W x L)	58 x 36 x 74,5 mm | 58 x 51,5 x 74,5 mm with beam dump
Control interface	USB and RS232
Controller	External

*Custom design available

Standard products

ATTENUATION RANGE	LIDT	WAVELENGTH	SKU
0,5 - 95 %	2 J/cm² (10 ns @ 266 nm)	257 nm	9326
		266 nm	9327
0,2 - 96 %	3 J/cm² (10 ns @ 355nm)	343 nm	9264
		355 nm	9263
0,1 - 98 %	5 J/cm² (10 ns @ 532 nm)	515 nm	9262
		532 nm	9260
	10 J/cm² (10 ns @ 1064 nm)	1030 nm	9259
		1064 nm	9258

Accessories for laser power attenuators LPA

RECOMMENDED ACCESSORY	FOR BEAM HEIGHT OF	SKU	PRICE
Post mounting set	50 mm or 76 mm (2" or 3")	9343	35 €
Post mounting set	73 – 125 mm (2,9" – 5")	9344	40 €
Dedicated beam dump with protective window	-	9345	115 €

Advanced motorized laser power attenuators LPA-A

Main features

- Integrated controller
- Absolute encoder - no homing required
- High accuracy - ±0,004 deg (less than ± 0,01 % of laser power)
- Resolution - 0,002 deg, 7,4 arcsec, 0,035 mrad
- Fast adjustment - less than 0,2 sec (min to max)
- High damage threshold: up to 10J/cm² (10 ns @ 1064 nm)
- Adjustable polarizer angle

Application examples

- Precise laser micromachining
- Laser power control and attenuation
- Research

Advanced laser power attenuator LPA-A is a compact motorized device for laser power control with an integrated controller and absolute encoder. The LPA-A is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm. This device is combined with the unique mechanical design which ensures repeatability and high stability of performance. All optical components of the LPA-A are made for high LIDT and provide a stable and reliable performance even when using them with high power lasers in industrial applications. A secondary laser beam from the laser power attenuator unit can be rejected to an external beam dump. The beam dump is used for avoiding any thermal effects or stress in the housing of the LPA-A device.

Standard specifications

ADVANCED VARIABLE MOTORIZED LASER POWER ATTENUATOR SPECIFICATIONS	
Input and output clear aperture	15 mm
Controller	Integrated
Dimensions (H x W x L)	86 x 47 x 58 mm
Control interface	USB or RS232

Standard products

ATTENUATION RANGE	LIDT	WAVELENGTH	SKU
0,5 - 95 %	2 J/cm² (10 ns @ 266 nm)	257 nm	11809
		266 nm	11810
	5 J/cm2 (10 ns @ 532 nm)	515+1030 nm	14898
0,2 - 96 %	3 J/cm² (10 ns @ 355nm)	343 nm	11808
		355 nm	11805
0,1 - 98 %	5 J/cm² (10 ns @ 532 nm)	515 nm	11807
		532 nm	11806
	10 J/cm² (10 ns @ 1064 nm)	1030 nm	11804
		1064 nm	11708

Accessories for laser power attenuators LPA-A

MOUNTING OPTION	FOR BEAM HEIGHT OF	SKU	PRICE
Post mounting set	76,2 - 100 mm (3" – 4")	9346	40 €
Post mounting set	57 - 65 mm (2,2" – 2,6")	9347	35 €
Dedicated beam dump with protective window	-	9345	115 €

Manual laser power attenuators LPA-M

Main features

- Industrial robust design
- Wide wavelength adoption 240 nm - 2 µm
- Cost effective

Application examples

- Laser micromachining
- Laser power attenuation
- Research

Optogama designs and manufactures industrial grade manual control laser power attenuators for use in the UV, visible, and NIR spectral ranges, from 240 nm to 2000 nm. All optical elements of these laser power attenuators are made for high LIDT and provide a stable and reliable performance even when using them with high power lasers in industrial applications.

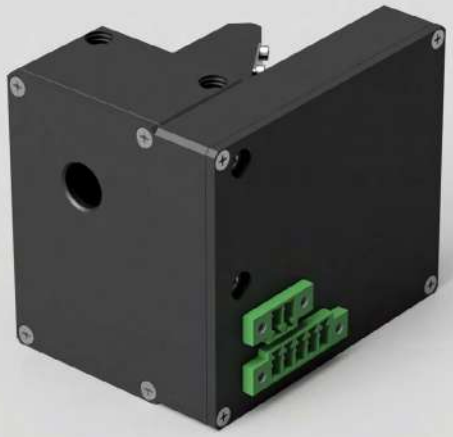
Standard specifications

VARIABLE MANUAL LASER POWER ATTENUATOR SPECIFICATIONS	
Adjustment	Manual
Input and output clear aperture	8 mm
Dimensions (H x W x L)	57 x 72 x 105 mm

*Custom design available

Standard products

MODEL	LIDT	WAVELENGTH	SKU
0,01 - 70%	>500 MW/cm² 10 ns @ 1064 nm	200-300 nm	18751
		350-2300 nm	18783
0,5-95 %	2 J/cm² (10 ns @ 266 nm)	257 nm	7896
		266 nm	7887
0,2-96 %	3 J/cm² (10 ns @ 355nm)	343 nm	7885
		355 nm	7886
0,1-98 %	5 J/cm² (10 ns @ 532 nm)	515 nm	7673
		532 nm	7672
	10 J/cm² (10 ns @ 1064 nm)	1030 nm	7671
		1064 nm	7670



OEM laser power attenuator LPA-OEM

Main features

- Compact, cost-effective design
- Detachable controller for better integration
- 175,543 µsteps in full rotation
- ±10 µsteps accuracy (± 0,02 deg, less than ± 0,05 % of laser power)
- Fast adjustment - less than 0,2 sec (min to max)
- High damage threshold up to 10 J/cm^2 (10 ns @ 1064 nm)
- Adjustable polariser angle for highest contrast

Application examples

- Precise laser micromachining
- Laser power control and attenuation
- Research
- Laser integration

OEM Laser power attenuator (LPA-OEM) is a compact, cost-effective motorised laser power control unit designed for integration. The LPA-OEM is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm. This device is combined with the unique mechanical design which ensures repeatability and high stability of performance. All optical components of the LPA are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications.

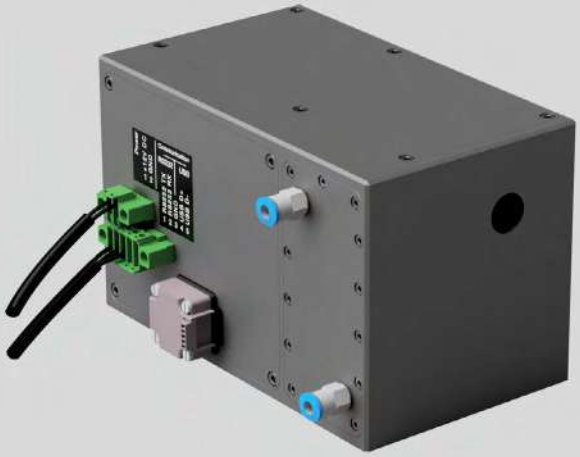
Standard specifications

LASER POWER ATTENUATOR LPA-OEM SPECIFICATIONS	
Input and output clear aperture	ø8 mm
Power attenuation range	<0,1% to >98%
LIDT coating	>10 [J/cm^2] (10 ns @ 1064 nm)
Close to open time	<0,2 sec
Resolution	175,543 µsteps in full rotation 21,943 µsteps in min/max rotation (0,002 deg, 7,2 arcsec, 0,035 mrad)
Accuracy	±10 µsteps (±0,02 deg, less than ±0,035%)
Dimensions (H x W x L)	58 x 36 x 57 mm LPA-OEM 58 x 50 x 67 mm LPA-OEM with beam controller 58 x 67 x 67 mm detached controller

*Custom design available

Standard products

MODEL	ATTENUATION RANGE	LIDT (COATING)	DESIGN WAVELENGTH	SKU
LPA-OEM	0,5 - 95%	2 J/cm2 (10 ns @ 266 nm)	257 nm	20051
LPA-OEM	0,5 - 95%	2 J/cm2 (10 ns @ 266 nm)	266 nm	20052
LPA-OEM	0,2 - 96 %	3 J/cm2 (10 ns @ 355 nm)	343 nm	20053
LPA-OEM	0,2 - 96 %	3 J/cm2 (10 ns @ 355 nm)	355 nm	20054
LPA-OEM	0,1 - 98 %	5 J/cm2 (10 ns @ 532 nm)	515 nm	20055
LPA-OEM	0,1 - 98 %	5 J/cm2 (10 ns @ 532 nm)	532 nm	20056
LPA-OEM	0,5 - 95 %	5 J/cm2 (10 ns @ 532 nm)	515+1030 nm	20059
LPA-OEM	0,1 - 98 %	10 J/cm2 (10 ns @ 1064 nm)	1030 nm	20057
LPA-OEM	0,1 - 98 %	10 J/cm2 (10 ns @ 1064 nm)	1064 nm	20058



Unpolarized beam motorized laser power attenuators LPA-U

Main features

- Designed for unpolarised laser beam
- Up to 200W of average laser power
- Beam offset compensated
- Integrated controller
- Absolute position encoder - no homing required
- High accuracy ±0,005 deg
- Robust design with water-cooling
- Clear aperture - ø12 mm
- Fast adjustment - less than 0,5 sec (min to max)
- High damage threshold: up to 10J/cm^2 (10 ns @ 1064 nm)

Application examples

- Precise laser micromachining
- Laser power stabilization
- Research

Advanced motorised laser power attenuator LPA-U is a unique device designed for unpolarised laser power control with integrated controller and absolute position encoder.
The LPA-U is produced in the UV, visible and NIR spectral ranges, from 343 nm to 2000 nm and 10,6 um. This device is combined with the unique mechanical robust design which ensures high repeatability.
All optical components of the LPA-U are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications.
A secondary laser beam from laser power attenuator unit is rejected to an internal beam dump. Water-cooling is used for avoiding any thermal effects or stress in the housing of the LPA-U device.

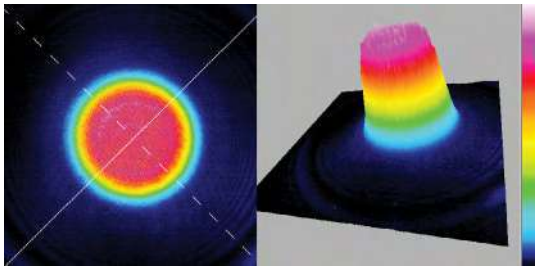
Standard specifications

UNPOLOARIZED BEAM MOTORIZED LASER POWER ATTENUATOR LPA-U SPECIFICATIONS	
Input and output clear aperture	12 mm
Controller	Integrated
Dimensions (H x W x L)	5 x 93,5 x 135 mm
Control interface	USB or RS232

Standard products

MODEL	ATTENUATION RANGE	DIMENSIONS (H X W X L)	DESIGN WAVELENGTH	SKU
LPA-U	2 - 95%	85 x 93,5 x 135 mm	1070 nm	21710
LPA-U	2,5 - 93%	85 x 93,5 x 135 mm	1064 nm	28839

Flat top converter FTC



Main features

- Quick change between Gaussian and Flat-top beam
- The beam profile remains Flat-Top shape along optical axis
- Integrated controller
- Designed according your laser specs.
- Clear aperture up to 15 mm
- Quick switching time - 0.2 sec
- High damage threshold up to 10J/cm^2 (10 ns @ 1064 nm)
- Conversion efficiency up to 70% (while on Flat-Top mode)

Application examples

- Precise laser micromachining
- Life sciences
- Research

Flat top converter unit is "all in one" motorized solution for a Gaussian beam transformation to a Flat-Top (Top Hat) beam. The beam profile remains Flat-Top shape along optical axis. The device consists of quartz wave-plate, space-variant wave-plate and a high contrast polarizer. The FTC is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm. All optical components of the FTC are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications. A secondary laser beam from Flat top converter unit can be rejected to an external beam dump. The beam dump is used for avoiding any thermal effects or stress in the housing of the FTC device.

Standard specifications

FLAT TOP CONVERTER FTC SPECIFICATIONS	
Input and output clear aperture	ø15 mm (depends on waveplate)
Conversion efficiency and transmission	Up to 70 % (Flat-Top beam mode) No less than 97 % (Gaussian beam mode)
LIDT coating	>10 [J/cm^2] (10 ns @ 1064 nm)
Controller	USB and RS232
Control interface	External
Dimensions (H x W x L)	105 x 53 x 62,5 mm FTC 105 x 70 x 62,5 mm FTC with beam dump (BD-6)

*Custom design available

Standard products

MODEL	APERTURE	WAVELENGTH	ADJUSTMENT	TYPE	CONTROL INTERFACE	TYPICAL APPLICATION	SKU
FTC	ø 6 mm	1030 nm	Motorised	DOE	USB or RS232	Flat top converter	19750
	ø 6 mm	515 nm	Motorised	DOE	USB or RS232	Flat top converter	19751
	ø 3 mm	1030 nm	Motorised	DOE	USB or RS232	Flat top converter	19752
	ø 3 mm	515 nm	Motorised	DOE	USB or RS232	Flat top converter	19753
	ø 6 mm	1064 nm	Motorised	DOE	USB or RS232	Flat top converter	19754
	ø 3 mm	1064 nm	Motorised	DOE	USB or RS232	Flat top converter	19755
	ø 6 mm	532 nm	Motorised	DOE	USB or RS232	Flat top converter	19756
	ø 3 mm	532 nm	Motorised	DOE	USB or RS232	Flat top converter	19757

Motorized polarization rotator MRO

Main features

- Compact design
- High resolution 175543 µsteps in 360 deg rotation
- High accuracy - ±10 µsteps accuracy (± 0,02 deg)
- Clear aperture - 18 mm
- Fast adjustment - less than 0,2 sec (0 to 45 deg)

Rotator (MRO) is a compact motorized device for laser polarization control. The MRO is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm. The device has external controller. All optical components of the MRO are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications.

Standard specifications

SPECIFICATIONS	
Clear aperture	ø 18 mm
Standard wavelengths	257 nm; 343 nm; 355 nm; 400 nm; 515 nm; 532 nm; 800 nm; 1030 nm; 1064 nm
LIDT coating	>10 [J/cm2] (10 ns @ 1064 nm)
Close to open time (0 to 45 deg)	< 0,2 sec
Resolution	175,543 µsteps in full rotation 21,943 µsteps in 45deg rotation (0,002 deg, 7,2 arcsec, 0,035 mrad)
Accuracy	±10 µsteps (±0,02 deg)
Motor	2 phase stepper motor, 200 steps with 256 µstepping
Mechanical dimensions	37,5 x 36 x 58 mm
Controller mechanical dimensions	125 x 53 x 31 mm
Software	LPA software

Standard products

CLEAR APERTURE	CONTROL INTERFACE	WAVEPLATE	RETARDATION	LIDT	SKU
18 mm	USB or RS232	1064 nm	L/2	10 J/cm2 (10 ns@1064 nm)	19706
		1030 nm	L/2	10 J/cm2 (10 ns@1030 nm)	19572
		532 nm	L/2	5 J/cm2 (10 ns@532 nm)	19705
		515 nm	L/2	5 J/cm2 (10 ns@515 nm)	19700
		355 nm	L/2	3 J/cm2 (10 ns@355 nm)	19702
		343 nm	L/2	3 J/cm2 (10 ns@343 nm)	19701
		266 nm	L/2	2 J/cm2 (10 ns@266 nm)	19703
		257nm	L/2	2 J/cm2 (10 ns@257 nm)	19704
		1064 nm	L/4	10 J/cm2 (10 ns@1064 nm)	19708
		1030 nm	L/4	10 J/cm2 (10 ns@1030 nm)	19479
		532 nm	L/4	5 J/cm2 (10 ns@532 nm)	19709
		515 nm	L/4	5 J/cm2 (10 ns@515 nm)	19478
		355 nm	L/4	3 J/cm^2 (10 ns@355 nm)	13527
		343 nm	L/4	3 J/cm2 (10 ns@343 nm)	19477
		266 nm	L/4	2 J/cm2 (10 ns@266 nm)	19711
		257nm	L/4	2 J/cm2 (10 ns@257 nm)	19710
		without optics	None	None	19707

激光器配件

可选配件装置

Laser accessories

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Infrared (IR) viewers

UV-NIR laser beam visualizers

Manual 4 axis translation stage

4 axis Kinematic mount

XY industrial holders

Compact laser modules

Infrared (IR) viewers

Main features

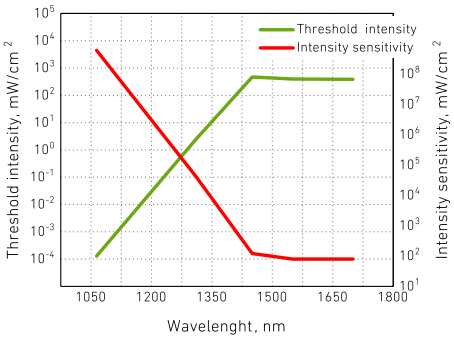
- Spectral region 400 - 1700 nm
- Resolution > 30 Lp/mm
- Hand-held / post mounted
- Up to 10 hours battery life, rechargeable
- Pulsed and CW light detection

Application examples

- Location and alignment of Nd: YAG Yb:YAG, Yb:KGW, Ti:Sapphire and other IR lasers
- Identification of stray IR reflectations
- Observation of GaAs laser diodes, IR LED's, dye and other IR-sources
- Forensic analysis on inks, pigments

The digital version of the IR viewer is based on the multiphoton absorption (MPA) phenomenon when the laser wavelength exceeds the linear spectral detection range of the silicon material.
In addition, the process of photoelectrons requires spatial and temporal filtering from noise to enhance the visualization of IR photons beyond the 1.1µm spectrum. By adjusting the gain on a pixel-by-pixel basis, it is possible to achieve imaging up to 1.7µm.

Spectral sensitivity



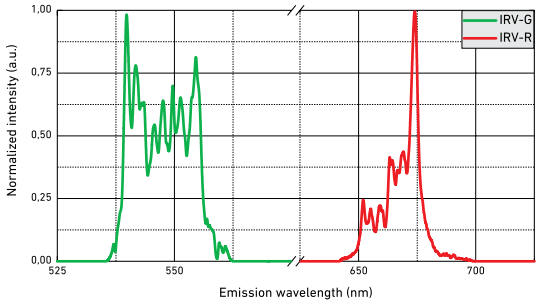
Standard specifications

IR-VIEWERS SPECIFICATIONS	
Resolution	>30 Lp/mm
Working distance of lens	12,5 (+/-0,2) mm
Distortion of image	<0,5 %
Battery life (continuous)	Up to 10 hours battery life, rechargeable 2x 18650 batteries
Weight	0,4 kg
Dimensions	153 x 175 x 51 mm

Standard products

FIELD OF VIEW	MAGNIFICATION	OBJECTIVE LENS	ADJUSTABLE IRIS	FOCUS	SPECTRAL SENSITIVITY	SKU
38°	1X	F1.3/8 mm	Included	0,1 m to infinity	400 - 1700 nm	31150
19°	2X	F1.4/16 mm	Included	0,5 m to infinity	400 - 1700 nm	31152

UV-NIR laser beam visualizers



Main features

- Wavelength detection from UV to NIR
- Suitable for CW and pulsed laser light
- High sensitivity to laser radiation – 0,1 mW/mm^2
- Damage threshold for pulsed laser – 1 J/cm^2, 10 ns
- Both sides are active

Application examples

- Laser alignment
- Research

Laser beam visualizers are designed to detect UV and IR both CW and pulsed laser light radiation. These visualizers are fabricated from aluminum with an organic polycrystal photosensitive region, which enables easy location of UV-VIS-NIR light beams and focal points. As it is not necessary to charge the active region both CW and pulsed laser light will be detected even in darkened room conditions.

Standard products

CLEAR APERTURE	ITEM MODEL	DETECTION SPECTRAL RANGE	EMISSION COLOR	THRESHOLD SENSITIVITY	SKU
35 mm	IRV-R-1	190-1090 + 1470-1600 nm	Red	0,01 W/cm^2	7662
	IRV-G-1	880-1070 nm	Green	0,02 W/cm^2	7661

Manual 4 axis translation stage

Main features

- Sapphire contact pads
- Industrial design
- 4 axis fine adjustment
- Maximum load up to 1,5 kg

Application examples

- Motorized beam expander MEX fine adjustment
- Precise alignment of optical components and other laser accessories

MSTAGE is an industrial mounting solution for MEX compact series beam expanders. This 4-axis manual translation stage contains a locking mechanism preserving the aligned position. It features sapphire contact pads determining long-lasting and smooth micro screw operation. There are four M6 x 0,25 micro screws for adjusting platform's pitch, yaw, Y and Z axis. Two micro screws control platform's pitch and Z axis, while another two-control yaw and Y axis. All of them can be adjusted with 2 mm HEX screwdriver.

Standard specifications

SPECIFICATIONS	
Travel range	Y axis: 8 mm (±4 mm)
	Z axis: 4 mm (±2 mm)
	Yaw: ±5.5 deg
	Pitch: ±2.5 deg
Resolution	Y axis: 8 mm (±4 mm)
	Z axis: 145 µm/rev
	Yaw: 0.018 deg/rev
	Pitch: 0.010 deg/rev
Maximum load	Mounted horizontally 1.5 kg
	Mounted vertically 0.6 kg

Standard products

MODEL	DIMENSION (W X H X L)	WEIGHT	HEX SCREWDRIVER	SKU
M-STAGE	75 x 28 x 100 mm	500 g	3mm, 2mm, 1.5 mm HEX	12571
M-STAGE-W	102 x 28 x 100 mm	650 g	3mm, 2mm, 1.5 mm HEX	29135

4 axis Kinematic mount

Main features

- Sapphire contact pads
- Locking mechanism of all 4 axis
- Industrial design
- 4 axis fine adjustment
- Maximum load up to 1 kg

Application examples

- Variable beam expander VEX fine adjustment
- Industrial mounting of other laser accessories

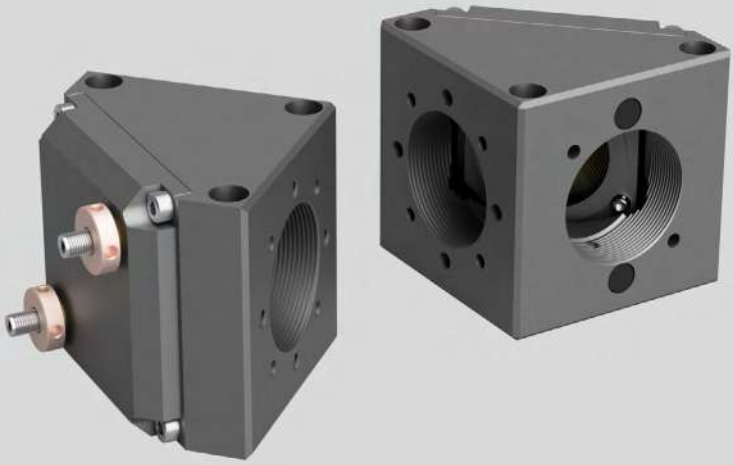
KMOUNT is an industrial mounting solution for VEX manual variable beam expanders.
This 4-axis manual kinematic mount contains a locking mechanism preserving the aligned position on all 4 axis. It features sapphire contact pads determining long-lasting and smooth micro screw operation.
There are 2x M6 x 0,25 and 2x 3/16"-100 micro screws for adjusting the platform's pitch, yaw, Y, and X-axis.
Two micro screws control platform's tilt, while another two-control XY axis.
All of them can be adjusted with a 2 mm HEX screwdriver.

Standard specifications

SPECIFICATIONS	
Travel range	Y axis: 8 mm (±4 mm)
	Z axis: 4 mm (±2 mm)
	Yaw: ±5.5 deg
	Pitch: ±2.5 deg
Resolution	Y axis: 8 mm (±4 mm)
	Z axis: 145 µm/rev
	Yaw: 0.018 deg/rev
	Pitch: 0.010 deg/rev
Maximum load	Mounted horizontally 1 kg

Standard products

DESCRIPTION	MOUNTING	WEIGHT	MOUNTING	SKU
VEX13	75 x 28 x 100 mm	500 g	55 mm	29270
VEX18	102 x 28 x 100 mm	500 g	55 mm	29271



XY industrial holders

Main features

- Sealed industrial design
- Reflection or Refraction + Transmission design
- Attaches together at any direction
- 3 axis fine adjustment
- Combines with sealing tubes for enclosing laser path

Application examples

- Precision optics mounting
- "Closed" optical system
- High power laser beam guiding
- Beam delivery systems

XY-IND are 2-axis and 3-axis sealed industrial kinematic mirror/splitter mounts. It combines with sealing tubes in both ends for optics and laser beam path protection from dust and environment. The mounts are easily attached together at any direction.

There are two types of holders:
- 2-axis and 3-axis Reflection type - is typically used with mirror.
- 3-axis Reflection + Transmission type - is typically used for splitting or filtering the laser beam.

Standard specifications

SPECIFICATIONS	
Angular range	±3,2 deg
Z axis*	±1,75 mm
Clear aperture	ø 16 mm (reflection type) ø 12 mm (transmission type)
Max. recommended beam size	ø 14 mm (reflection type) ø 10 mm (transmission type)
Max. recommended beam size 1/e2	ø 10 mm (reflection type) ø 8 mm (transmission type)
Fits	ø 25,0-25,4 mm (1,0"), 2-5 mm thickness
Angular	0,45 deg/rev 8 mrad/rev
Z axis	254 µm/rev
Adjustment microscrew	2 mm HEX

Standard products

DESCRIPTION	ITEM MODEL	MATERIAL	DIMENSIONS	SKU
XY holders (Reflection)	XYIND-2R-B	Black anodized aluminium	50 x 50 x 50 mm (H x W x L)	20020
XYZ holders (Reflection)	XYIND-3R-B	Black anodized aluminium	50 x 50 x 50 mm (H x W x L)	20021
XYZ holders (Reflection / Transmission)	XYIND-3RT-B	Black anodized aluminium	50 x 50 x 50 mm (H x W x L)	20022
XYZ holders (Reflection)	XYIND-2R-N	Natural anodized aluminium	50 x 50 x 50 mm (H x W x L)	29094
XYZ holders (Reflection)	XYIND-3R-N	Natural anodized aluminium	50 x 50 x 50 mm (H x W x L)	29095
XYZ holders (Reflection / Transmission)	XYIND-3RT-N	Natural anodized aluminium	50 x 50 x 50 mm (H x W x L)	29096
Holder locking nuts (2 pcs)	XYIND-2-LOCKS	Bronze	12,5 x 3,8 mm (D x T)	28250
Holder locking nuts (3 pcs)	XYIND-3-LOCKS	Bronze	12,5 x 3,8 mm (D x T)	28251
Tube seal with o-ring	XYIND-SEAL-SM1-B	Black anodized aluminium	32 x 24 mm (D x L)	28252
Tube seal with o-ring	XYIND-SEAL-SM1-N	Natural anodized aluminium	32 x 24 mm (D x L)	29092
Tube joint with o-ring	XYIND-TUBE-JOINT-B	Black anodized aluminium	32 x 40 mm (D x L)	28253
Tube joint with o-ring	XYIND-TUBE-JOINT-N	Natural anodized aluminium	32 x 40 mm (D x L)	29093
Sealing tube	XYIND-TUBE-N-1	Natural anodized aluminium	22 x 1000 mm (D x L)	28254
Sealing tube (custom length)	XYIND-TUBE-N-C05	Natural anodized aluminium	22 x 0 ... 500 mm (D x L)	28255
Sealing tube (custom length)	XYIND-TUBE-N-C051	Natural anodized aluminium	22 x 500 ... 1000 mm (D x L)	28256
Sealing tube	XYIND-TUBE-B-05	Black anodized aluminium	22 x 500 mm (D x L)	28257
Sealing tube (custom length)	XYIND-TUBE-B-C025	Black anodized aluminium	22 x 0 ... 250 mm (D x L)	28258
Sealing tube (custom length)	XYIND-TUBE-B-C02505	Black anodized aluminium	22 x 250 ... 500mm (D x L)	28259

Compact laser modules

Main features

- Industrial design
- 2 axis fine adjustment
- Locking mechanism of all 2 axis

Application examples

- Beam alignment
- Demonstration of laser systems

The compact laser module (CLM) is a precision-engineered optical tool designed to operate at 520 and 635 nm wavelengths. Offering adjustable beam control, with ±3° pointing angle, < 1 mrad beam divergence, and 4,5 mW of average power. It can be used in laser system alignment, optical experimentation, and educational demonstrations, providing reliability in a compact package.

Standard specifications

SPECIFICATIONS	
Operation wavelength	520, 635 nm
Mode of operation	CW
Average output power	4,5 ± 3 mW
Beam mode	Single mode
Beam diameter	4 mm
Beam divergence	< 1 mrad
Operating temperature	-10°C to +50°C
Electrical power consumption	3-5 V AC, <160 mA
Laser head size (L x W x H)	39 x 27 x 41 mm
Pointing adjustment	±3°
Degree per rotation	0,5°/rotation

Standard products

WAVELENGTH	AVERAGE POWER	BEAM DIAMETER	LASER HEAD SIZE (L X W X H)	PONTING ADJUSTMENT	SKU
520 nm	4,5 ± 0,3 mW	4 mm	39 x 27 x 41 mm	±3°	31037
635 nm	4,5 ± 0,3 mW	4 mm	39 x 27 x 41 mm	±3°	31038

激光器晶体

Laser crystal

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als

Ti:Sapphire

Cr:LiSAF

Pr:YLF

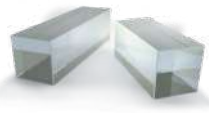
Ho:YLF

Tm, Ho:KYW

Nd-doped

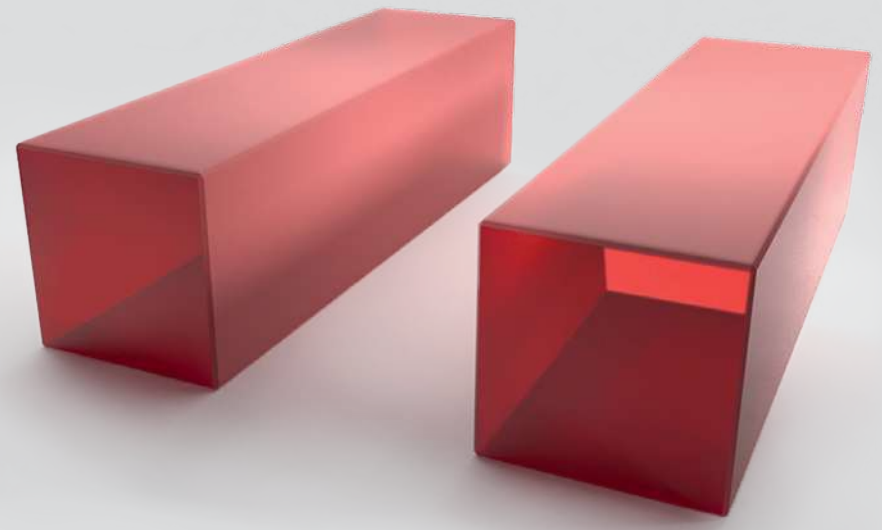
Yb-doped

Er-doped



Er, Yb co-doped

Tm-doped



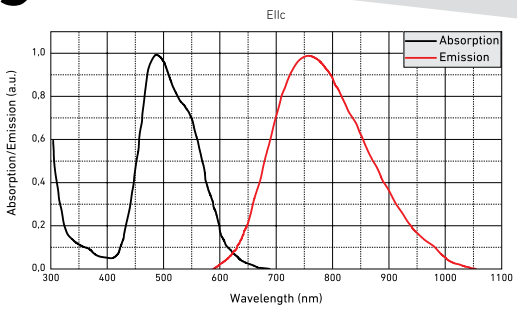
Ti:Sapphire crystals

Main features

- Excellent thermal conductivity
- Broad gain bandwidth
- Wide range of possible pump wavelengths (typically 532 nm)
- Custom crystals available upon request

Application examples

- Mode-locked lasers with ultrashort pulses
- Multi-pass amplifiers and regenerative amplifiers



Titanium-doped sapphire ($Ti^{3+}:Al_2O_3$) is a widely used transition-metal-doped laser crystal. Ti^{3+} ion has a very large gain bandwidth, that opens possibility to obtain very wide wavelength tunability realized in short pulse lasers.

To obtain crystals with good optical quality Ti^{3+} doping concentration should not exceed 0,25 at.%. Ti:Sapphire crystal is characterized by a short upper-state lifetime and a high saturation power. All these properties lead to the necessity of using a strongly focused pump beam.

Standard specifications

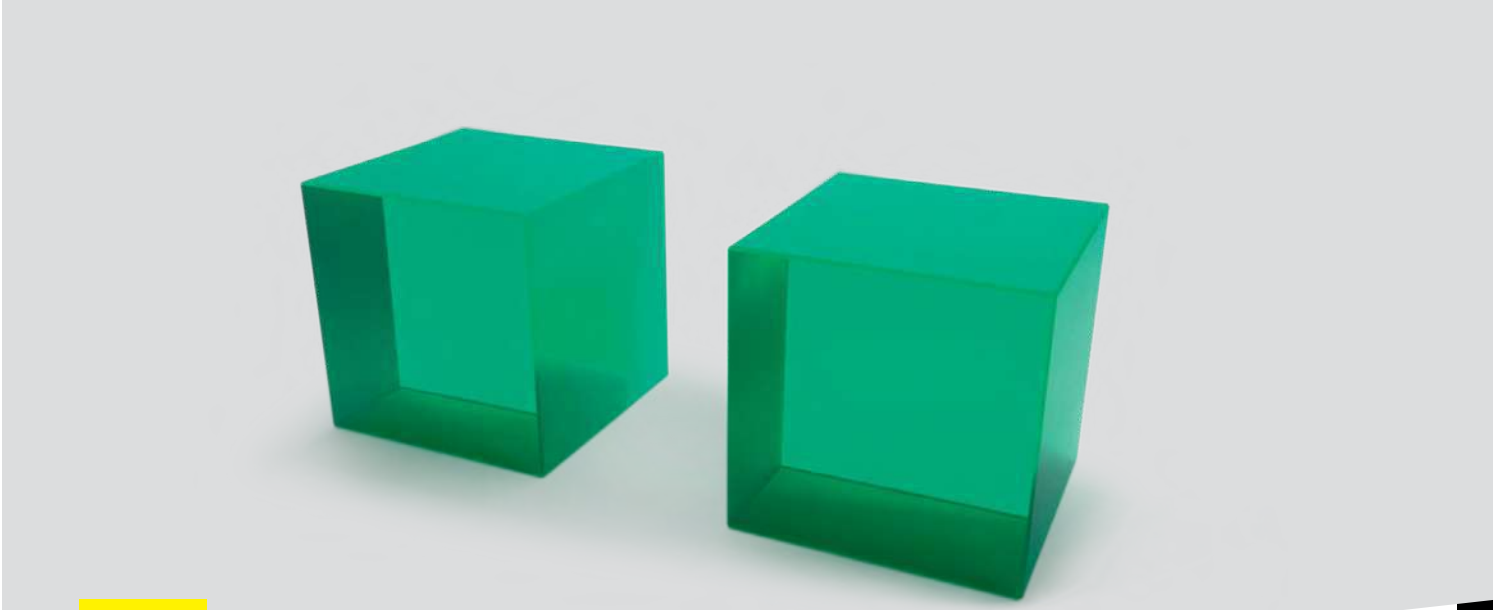
TI:SAPPHIRE CRYSTALS	
Orientation	a-cut
Absorption	90-95% of 532 nm pump radiation
Figure of merit	>150 (for 15 mm and longer crystals)
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<30 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,15 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/10@632,8 nm (for 6x6 mm and smaller crystals)
Wavefront distortion	λ/4@632,8 nm
Coatings	AR(R<1%)@532 nm + AR(R<0,3%)@750-850 nm on both faces
LIDT	>2 J/cm²@800 nm, 300 ps
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	~500 nm
Absorption cross-section at peak wavelength	38×10^{-20} cm²
Laser wavelength	790 (670-1070) nm
Lifetime of energy level	3,2 µs
Emission cross-section @790 nm	41×10^{-20} cm²
Refractive index @800 nm	1,76
Crystal structure	hexagonal
Density	3,98 g/cm³
Mohs hardness	9
Thermal conductivity	33 $Wm^{-1}K^{-1}$
dn/dT	13×10^{-6} K^{-1}
Thermal expansion coefficient	5×10^{-6} K^{-1}
Typical doping level	0,1-0,25 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	COATINGS	SKU
3 x 3 mm	5 mm	Brewster-angle cut	Uncoated	6633
3 x 3 mm	5 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6632
6 x 6 mm	7 mm	Brewster-angle cut	Uncoated	6635
6 x 6 mm	7 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6634
6 x 6 mm	10 mm	Brewster-angle cut	Uncoated	6637
6 x 6 mm	10 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6636
6 x 6 mm	15 mm	Brewster-angle cut	Uncoated	6639
6 x 6 mm	15 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6638
ø6 mm	20 mm	Brewster-angle cut	Uncoated	6641
ø6 mm	20 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6648
ø12 mm	15 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6640
ø16 mm	20 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6642
ø20 mm	25 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6643
ø30 mm	25 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6644
ø40 mm	25 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6645
ø50 mm	25 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6646
50 x 50 mm	30 mm	Right-angle cut	AR/AR@532 nm + 750-850 nm	6647



Cr:LiSAF crystals

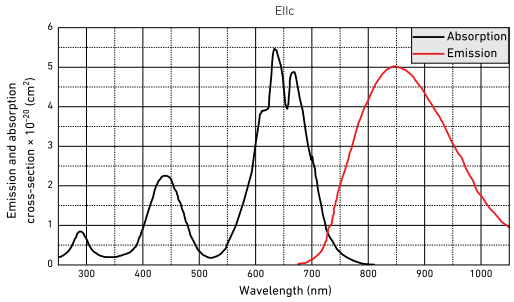
Main features

- Broad absorption and emission bands
- Nonlinear refractive index is about four times lower than that of Ti:Sapphire
- Custom crystals available upon request

Application examples

- Femtosecond lasers and CPA laser systems

Cr^{3+}:LiSAF gain medium possesses a broad emission band in the near infrared that allows a widely tunable laser operation and generation of ~10 fs light pulses via mode-locking technique. Cr:LiSAF crystals can be grown with a very low loss level (<0,2%/cm). It enables to construct high-Q-cavities, resulting in lasing thresholds as low as 2 mW and slope efficiencies above 50%. Moreover, nonlinear refractive index of Cr:LiSAF is about four times lower than that of Ti:sapphire, which reduces parasitic nonlinearities in the ultrashort pulse generation and amplification applications.



Standard specifications

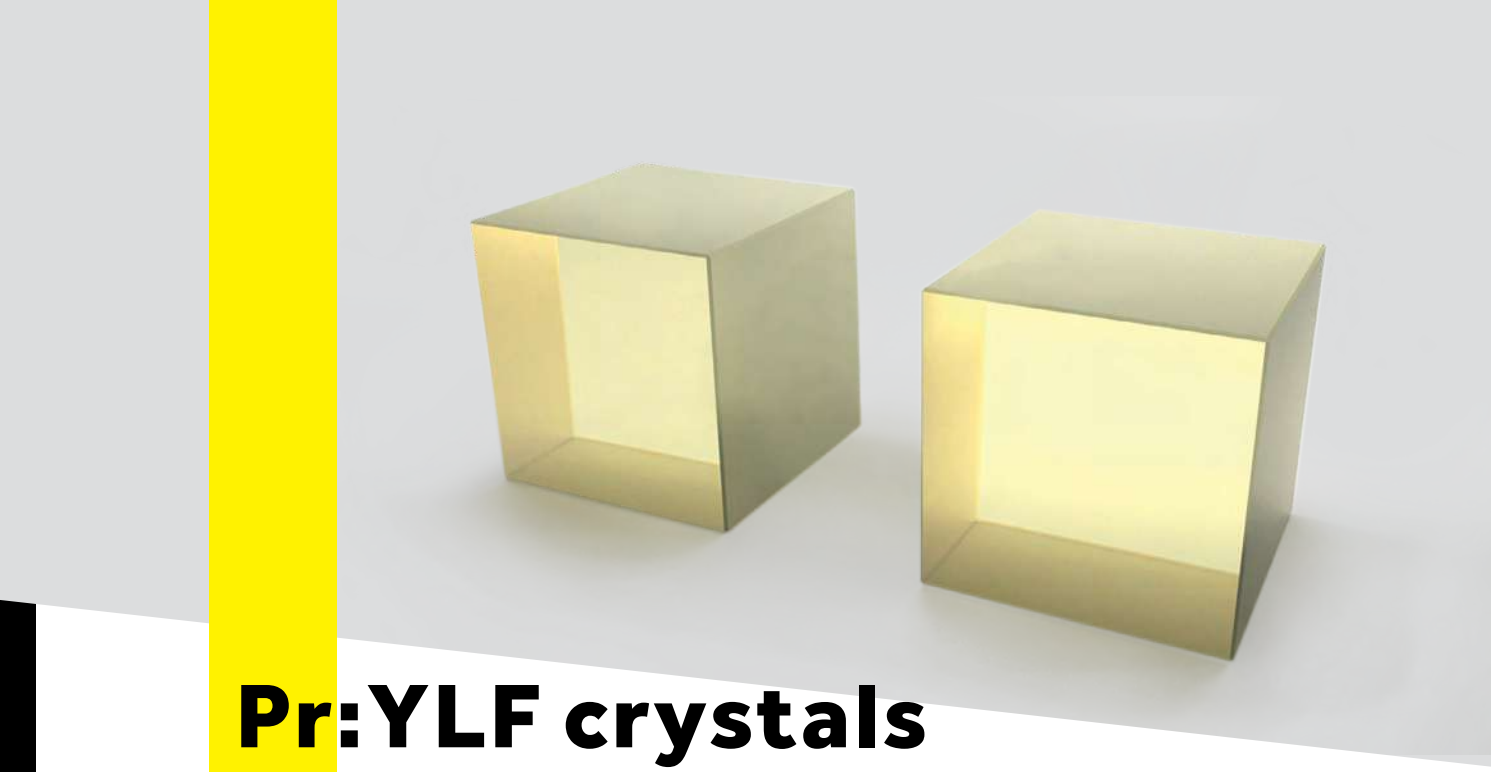
CR:LISAF CRYSTALS	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<1%)@670 nm + AR(R<0,5%)@700-1100 nm on both faces
Laser induced damage threshold	>10 J/cm²@1064 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	670 nm
Absorption cross-section at peak	5,5 × 10^{-20} cm^2
Absorption bandwidth at peak wavelength	~100 nm
Laser wavelength	830 (780-920) nm
Lifetime of $^4T_2$ energy level	67 µs
Emission cross-section	5 × 10^{-20} cm^2
Refractive index	1,41
Crystal structure	trigonal
Density	3,45 kg/cm^3
Mohs hardness	4
Thermal conductivity	4,6(||a), 5,1 (||c) $Wm^{-1}K^{-1}$
dn/dT	-4,2 × 10^{-6} K^{-1} (n_o), -4,6 × 10^{-6} K^{-1} (n_e)
Thermal expansion coefficient	22 × 10^{-6}(||a) K^{-1}, 3,6 × 10^{-6}(||c) K^{-1}
Typical doping level	0,8-3 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
5 x 5 mm	12 mm	Brewster-angle cut	3%	Uncoated	7820
		Right-angle cut	3%	AR/AR@670 nm + 700-1100 nm	7819



Pr:YLF crystals

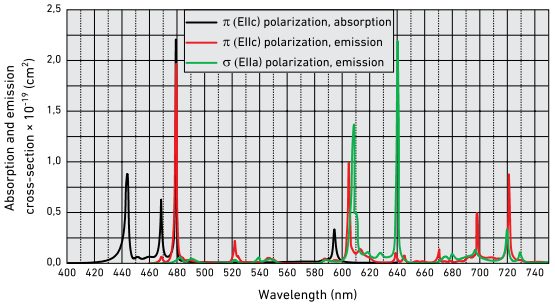
Main features

- High absorption and emission cross-sections(~10^{-19} cm^2)
- Good overlapping of the absorption band in the blue spectral region with the emission lines of the InGaN laser diodes and 2ω-OPSL
- Custom crystals available upon request

Application examples

- Diode-pumped solid-state lasers for precise and efficient processing of metals such as copper or gold, entertainment industry and science

Very few laser materials have necessary properties for realization of lasing in the visible spectral range. Trivalent praseodymium (Pr^{3+}) is known to be an interesting laser ion for using with solid-state lasers in the visible spectral range because of its energy levels scheme, providing several transitions in the red (640 nm, $^3P_0$ to $^3F_2$), orange (607 nm, $^3P_0$ to $^3H_6$), green (523 nm, $^3P_0$ to $^3H_5$), and dark red (720 nm, $^3P_0$ $^3F_3$+$^3F_4$) spectral regions. Pr^{3+}:YLF has been found to be a promising laser material for producing visible lasers directly and UV lasers through intracavity second-harmonic generation.



Standard specifications

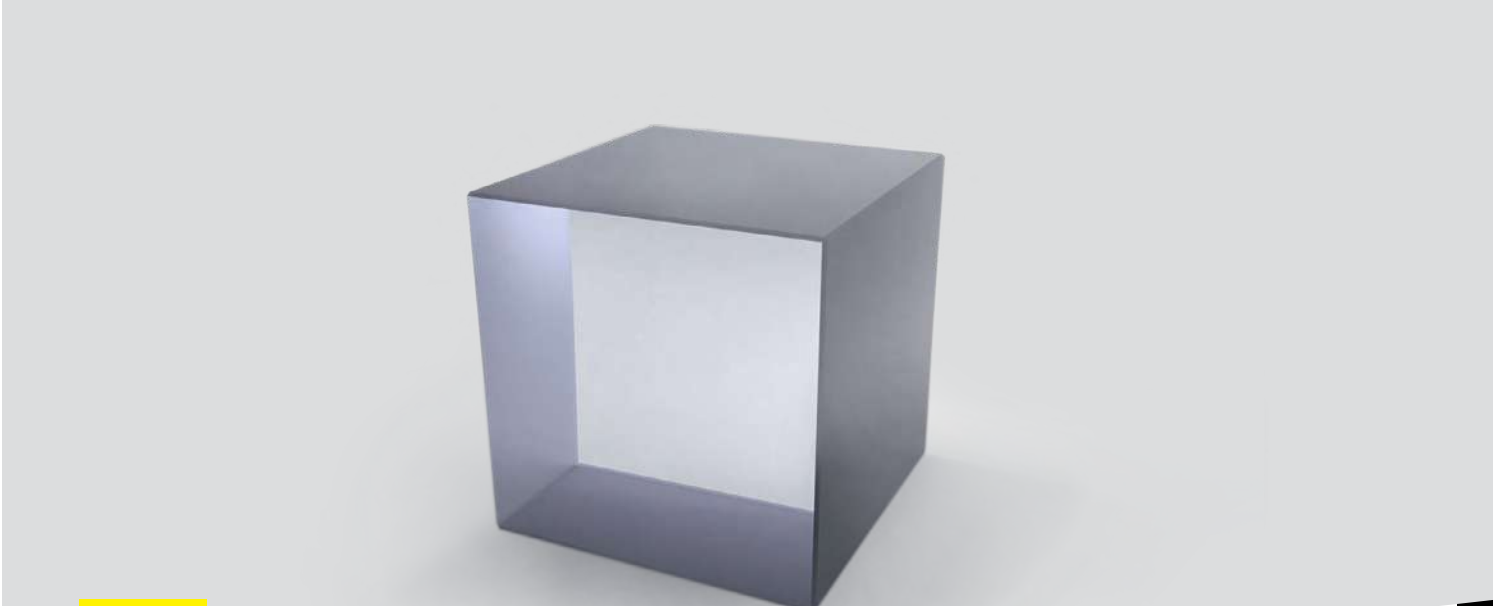
PR:YLF CRYSTALS	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	λ/4@632,8 nm
Coatings	AR(R<1%)@440-444 nm + AR(R<0,6%)@500-650 nm + AR(R<1%)@650-725 nm on both faces
Laser induced damage threshold	>5 J/cm^2@532 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	444 nm
Absorption cross-section at peak	8 × 10^{-20} cm^2
Absorption bandwidth at peak wavelength	~5 nm
Laser wavelength	523 nm, 607 nm, 639 nm, 698 nm, 721 nm
Lifetime of $^3P_0$ energy level	50 µs
Emission cross-section at 640 nm	20 × 10^{-20} cm^2
Refractive index @1064 nm	n_o = 1,448, n_e = 1,470
Crystal structure	tetragonal
Density	3,95 g/cm^3
Mohs hardness	5
Thermal conductivity	6 $Wm^{-1}K^{-1}$
dn/dT	-5,2 × 10^{-6} (||c) K^{-1}, -7,6 × 10^{-6} (||a) K^{-1}
Thermal expansion coefficient	~16 × 10^{-6} K^{-1}
Typical doping level	<1 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
2 x 2 mm	6 mm	Right-angle cut	0,5%	AR/AR@440-444 nm + 500-725 nm	7793
3 x 3 mm	6 mm	Right-angle cut	0,5%	AR/AR@440-444 nm + 500-725 nm	7794
ø5 mm	6 mm	Right-angle cut	0,5%	AR/AR@440-444 nm + 500-725 nm	7795



Ho:YLF crystals

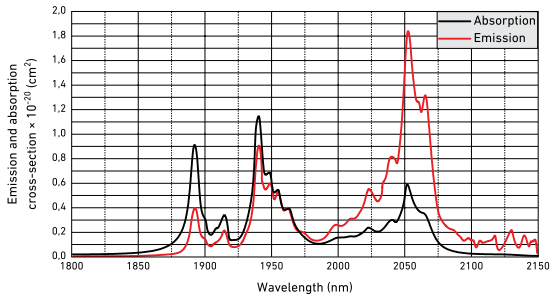
Main features

- Long upper laser level lifetime
- High emission cross-section
- Naturally birefringent material
- Low value of dn/dT leading to a weak thermal lensing
- Custom crystals available upon request

Application examples

- Remote sensing and pollutant detection
- Industry
- Defence

Direct pumping of Ho:YLF crystals excludes losses of Tm^{3+} to Ho^{3+} energy transfer process. Ho^{3+}:YLF crystal is characterized by a long lifetime of $^5I_7$ energy level which results in an excellent performance in Q-switched operation.



Standard specifications

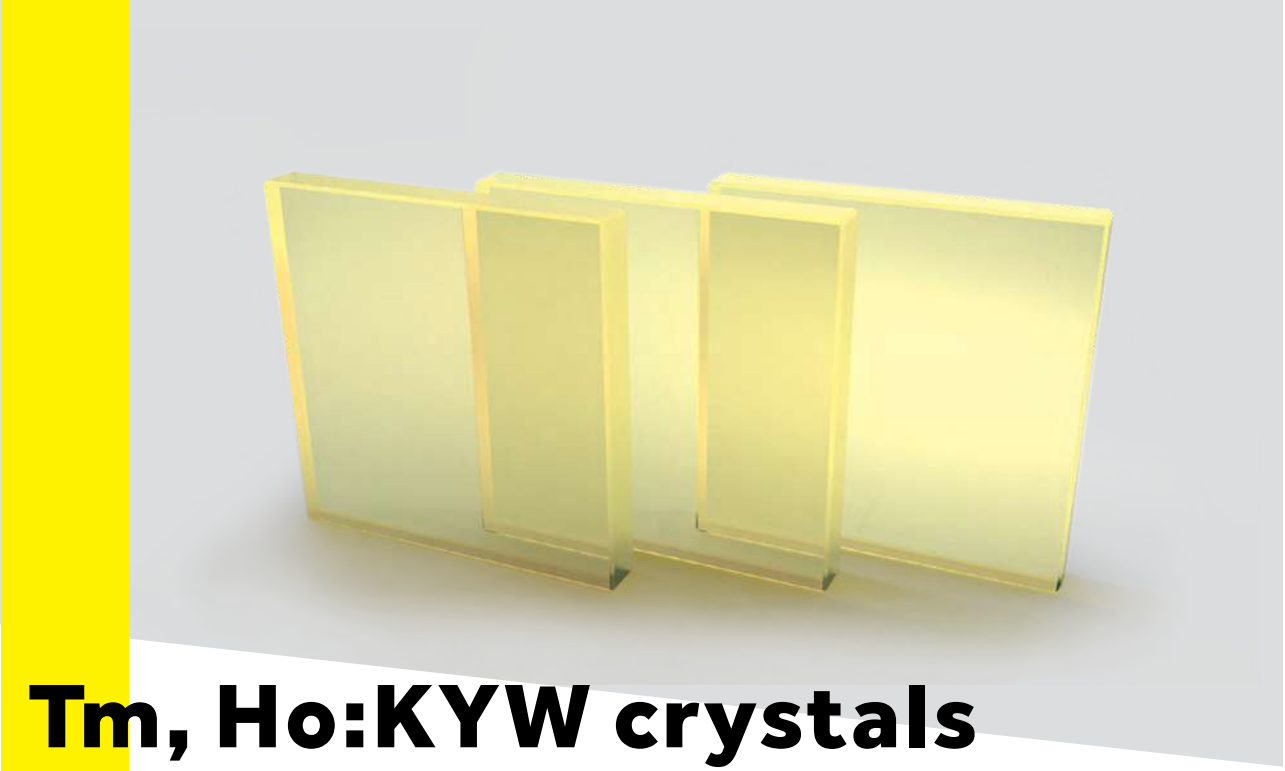
HO:YLF CRYSTALS	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,35%)@1900-2100 nm on both faces
LIDT	>10 J/cm²@2060 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	1940 nm
Absorption cross-section at peak	$1,2 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	~18 nm
Laser wavelength	2060 nm
Lifetime of $^5I_7$ energy level	10 ms
Emission cross-section	$1,8 \times 10^{-20}$ cm²
Refractive index @1064 nm	n_o = 1,448, n_e = 1,470
Crystal structure	tetragonal
Density	3,95 g/cm³
Mohs hardness	5
Thermal conductivity	6 $Wm^{-1}K^{-1}$
dn/dT	$-4,6 \times 10^{-6}$ (||c) K^{-1}, $-6,6 \times 10^{-6}$ (||a) K^{-1}
Thermal expansion coefficient	$10,1 \times 10^{-6}$ (||c) K^{-1}, $14,3 \times 10^{-6}$ (||a) K^{-1}
Typical doping level	0,5-1%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
5 x 5 mm	2 mm	Brewster-angle cut	1%	Uncoated	7857
	2 mm	Right-angle cut	1%	AR/AR@1900-2100 nm	7858
ø8 mm	2 mm	Brewster-angle cut	1%	Uncoated	7859
	2 mm	Right-angle cut	1%	AR/AR@1900-2100 nm	7860



Tm, Ho:KYW crystals

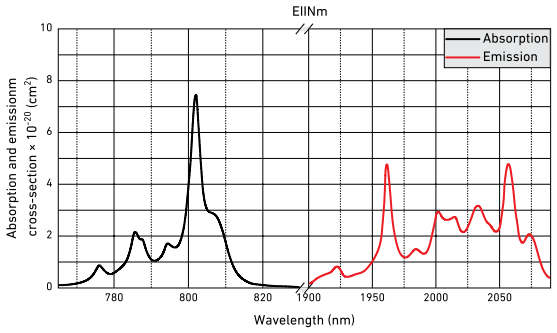
Main features

- Large and broad polarized absorption and emission bands
- Efficient energy transfer from Tm^{3+} to Ho^{3+}
- High dopant concentration with low concentration-quenching
- Custom crystals available upon request

Application examples

- 2 µm lasers for remote sensing (LIDAR technology), metrology and medical applications
- Pump source of mid-IR optical parametric oscillators (OPOs)

Ho^{3+} ions are characterized by higher emission cross-sections and longer upper laser level lifetimes compared to their Tm^{3+} counterparts. These features are desirable for a low-threshold and efficient laser operation. Ho^{3+} does not possess any strong absorption lines that are well matched to the outputs of commercially available laser diodes, therefore co-doping of Ho^{3+} with Tm^{3+} is chosen for an efficient operation across the 2 µm region through the energy transfer route from Tm^{3+} to Ho^{3+}. Tm, Ho:KYW crystals are characterized by large and broad polarized absorption and emission bands, efficient energy transfer from Tm^{3+} to Ho^{3+}.



Standard specifications

TM, HO:KYW CRYSTALS	
Orientation	N_g-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@802 nm + AR(R<0,2%)@2000-2100 on both faces
LIDT	>10 J/cm²@2060 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	802 nm
Absorption cross-section at peak	$7,6 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	~4 nm
Laser wavelength	2060 nm
Lifetime of $^5I_7$ energy level	1,8 ms
Emission cross-section @2056 nm	$4,7 \times 10^{-20}$ cm²
Refractive index @1040nm	$n_g = 2,05$, $n_m = 2,01$, $n_p = 1,97$
Crystal structure	monoclinic
Density	6,5 g/cm³
Mohs hardness	4-5
Thermal conductivity	~3,3 $Wm^{-1}K^{-1}$
dn/dT	$dn_m/dT = -9,2 \times 10^{-6}$ K^{-1}
Thermal expansion coefficient	$\alpha_p = 1,83 \times 10^{-6} K^{-1}$, $\alpha_m = 10,29 \times 10^{-6} K^{-1}$, $\alpha_g = 15,94 \times 10^{-6} K^{-1}$
Typical doping level	5 at.% [Tm] 0,5 at.% [Ho]

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	2 mm	Brewster-angle cut	Tm 5%, Ho 0,5%	Uncoated	7856
		Right-angle cut	Tm 5%, Ho 0,5%	AR/AR@802 nm + 2000-2100 nm	7855

Nd:KGW crystals

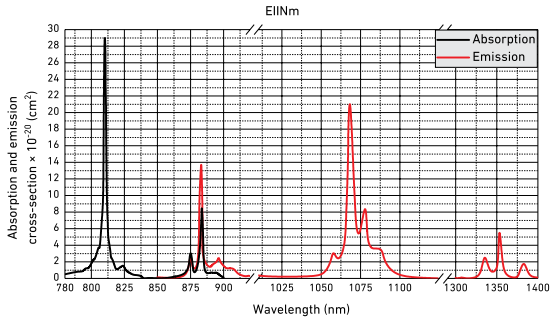
Main features

- Suitable for generation of picosecond light pulses, well suited for diode-pumped lasers
- High storage density and low laser threshold
- Efficient Raman converter
- Custom crystals available upon request

Application examples

- Diode-pumped Q-switched lasers emitting in the "eye-safe" spectral range for laser rangefinders
- Raman converter

Nd:KGW crystal is a good choice for generation of picosecond laser pulses. These crystals are characterized by a lower stimulated emission cross-section compared to Nd:YAG crystals, therefore provide a better performance in Q-switched operation. It is worth to mention, that it is possible to use the Nd:KGW laser crystal itself as a Raman converter.



Standard specifications

ND:KGW CRYSTALS	
Orientation	b(N_p)-cut,
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)808-811 nm + AR(R<0,15%)@1067 nm on both faces
Laser induced damage threshold	>10 J/cm²@1067 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	811 nm
Absorption cross-section at peak	28×10^{-20} cm²
Absorption bandwidth at peak wavelength	11 nm
Laser wavelength	1067 nm
Lifetime of $^4F_{3/2}$ neodymium energy level	130 µs
Emission cross-section @1067 nm	21×10^{-20} cm²
Refractive index @1067nm	n_g= 2,033, n_p= 1,937, n_m= 1,986
Crystal structure	Monoclinic
Density	7,25 g/cm³
Mohs hardness	4-5
Thermal conductivity	~3 $Wm^{-1}K^{-1}$
dn/dT	$dn_p/dT = -15{,}7\times10^{-6}\ K^{-1}$ $dn_m/dT = -11{,}8\times10^{-6}\ K^{-1}$ $dn_g/dT = -17{,}3\times10^{-6}\ K^{-1}$
Thermal expansion coefficient	$\alpha_p = 1{,}60 \times 10^{-6}\ K^{-1}$, $\alpha_m = 4 \times 10^{-6}\ K^{-1}$, $\alpha_g = 8{,}5 \times 10^{-6}\ K^{-1}$
Typical doping level	2-10 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	5 mm	Right-angle cut	3%	AR/AR@808-811 nm + 1067 nm	7798
ø3 mm	60 mm	Right-angle cut	3%	AR/AR@1067 nm	7800
3 x 3 mm	3 mm	Right-angle cut	5%	AR/AR@808-811 nm + 1067 nm	7796
3 x 3 mm	5 mm	Right-angle cut	5%	AR/AR@808-811 nm + 1067 nm	7797
ø3 mm	5 mm	Brewster-angle cut	5%	Uncoated	7799

Nd:YAG crystals

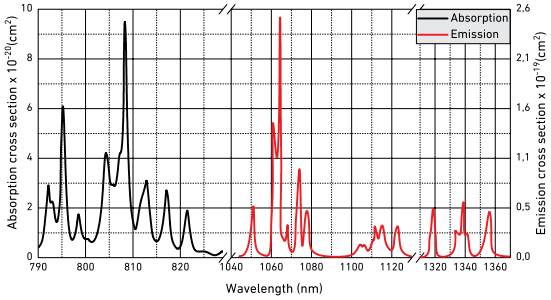
Main features

- Isotropic crystal (cubic symmetry)
- High thermal conductivity
- High optical quality and large diameter boules grown by Czochralski growth method
- Low lasing threshold and wide absorption band at near 808 nm that coincides with the emission of AlGaAs laser diodes
- Custom crystals available upon request

Application examples

- CW and pulsed operation at 1064 nm, 532 nm, 355 nm, 266 nm
- Material processing, welding, cutting
- Laser systems for medical applications

Nd3+:YAG crystal is the most widely used solid-state laser material. These crystals are characterized by relatively small gain bandwidth, which allows achieving a high gain efficiency and a relatively low lasing threshold. Nd:YAG crystals feature excellent thermal and mechanical properties. Nd:YAG of high optical quality and large diameter can be grown.



Standard specifications

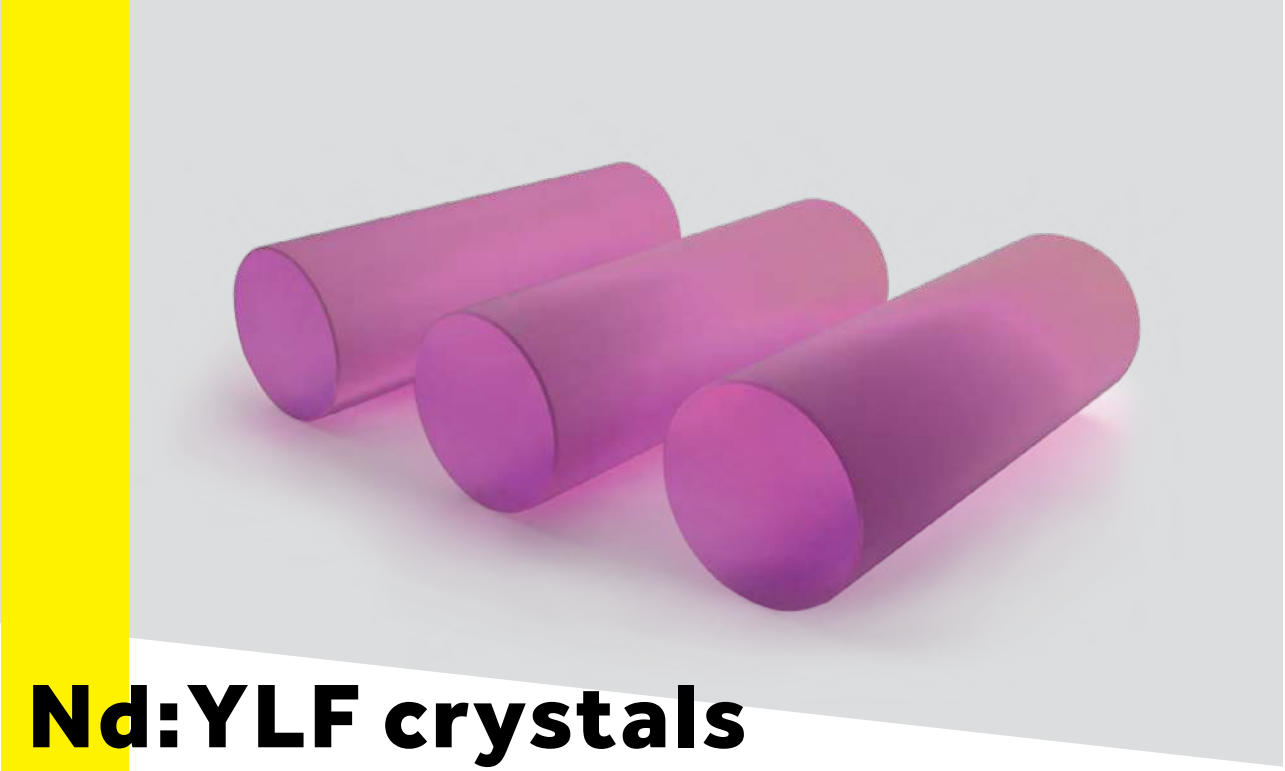
ND:YAG CRYSTALS	
Orientation	[111]
Extinction ratio	>28 dB
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	λ/4@632,8 nm
Coatings	AR(R<0,15%)@1064 nm on both sides or HT(T>95%)@808 nm + HR(R>99,5%)@1064 nm/ AR(R<0,15%)@1064 nm
Laser induced damage threshold	>10 J/cm²@1064 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	808 nm
Absorption cross-section at peak	$6,7 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	2,5 nm
Laser wavelength	1064 nm
Lifetime of $^4F_{3/2}$ neodymium energy level	250 µs
Emission cross-section @1064	3×10^{-19} cm²
Refractive index @1064 nm	1,82
Crystal structure	cubic
Density	4,56 g/cm³
Mohs hardness	8,5
Thermal conductivity	~13 $Wm^{-1}K^{-1}$
dn/dT	$9,86 \times 10^{-6}$ K^{-1}
Thermal expansion coefficient	$6,96 \times 10^{-6}$ K^{-1}
Typical doping level	0,6 - 1,3 at. %

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS
ø3 mm	10 mm	Right-angle cut	0,8%	AR/AR@1064 nm
	50 mm	Right-angle cut	0,8%	AR/AR@1064 nm
	100 mm	Right-angle cut	0,8%	AR/AR@1064 nm
ø5 mm	10 mm	Right-angle cut	0,8%	AR/AR@1064 nm
	50 mm	Right-angle cut	0,8%	AR/AR@1064 nm
	100 mm	Right-angle cut	0,8%	AR/AR@1064 nm
ø3 mm	10 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	50 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	100 mm	Right-angle cut	1,1%	AR/AR@1064 nm
ø5 mm	10 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	50 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	100 mm	Right-angle cut	1,1%	AR/AR@1064 nm
3 x 3 mm	2 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	2 mm	Right-angle cut	1,1%	HT@808 nm + HR@1064 nm/AR@1064 nm
	3 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	3 mm	Right-angle cut	1,1%	HT@808 nm + HR@1064 nm/AR@1064 nm
	5 mm	Right-angle cut	1,1%	AR/AR@1064 nm
	5 mm	Right-angle cut	1,1%	HT@808 nm + HR@1064 nm/AR@1064 nm



Nd:YLF crystals

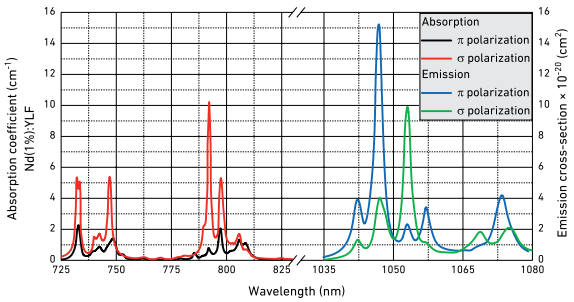
Main features

- Long lifetime of $^4F_{3/2}$ neodymium energy level
- Considerably softer and more brittle than Nd:YAG is
- Nd:YLF (a-cut) crystals that are used inside a laser optical resonator are self-polarizing
- Custom crystals available upon request

Application examples

- CW and pulsed operation at 1047nm and 1053 nm
- Material processing, welding, cutting

Nd^{3+}:YLF crystal is characterized by a long lifetime of $^4F_{3/2}$ neodymium energy level. Compared to Nd:YAG, the lower thermal conductivity and a weak negative dn/dT lead to lower thermal distortions and allow to achieve a better output beam quality. Another distinctive feature is the high UV transparency, which is favorable for pumping with xenon flashlamps.



Standard specifications

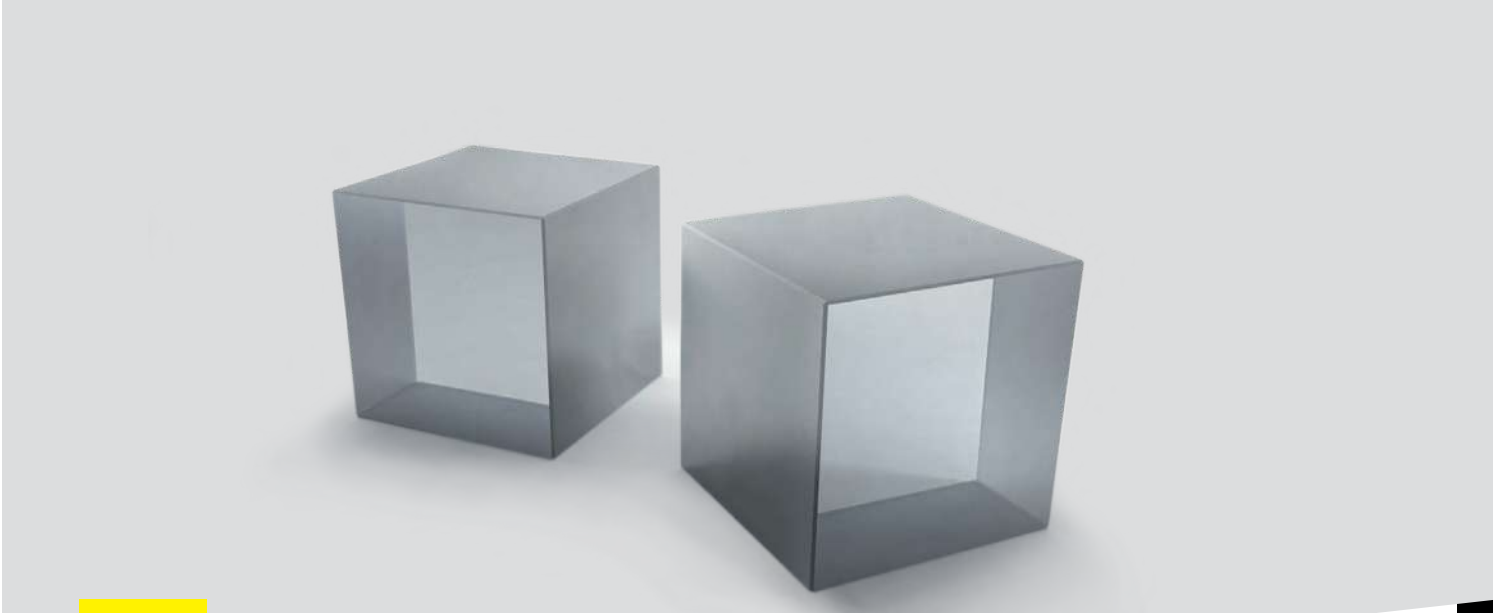
ND:YLF CRYSTALS	
Orientation	a-cut, c-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	λ/4@632,8 nm
Coatings	AR(R<0,5%)@790-810 nm + AR(R<0,2%) @1047-1053 nm on both faces
Laser induced damage threshold	>10 J/cm²@1064 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	792 nm
Absorption coefficient at peak	10 cm^{-1}
Absorption bandwidth at peak wavelength	~5 nm
Laser wavelength	1047, 1053 nm
Lifetime of $^4F_{3/2}$ neodymium energy level	485 µs
Emission cross-section	15 × 10^{-20} (E||C) cm^2@1047 nm 10 × 10^{-20} (E⊥C) cm^2@1053 nm
Refractive index @1064 nm	n_o = 1,448, n_e = 1,470
Crystal structure	tetragonal
Density	3,95 g/cm^3
Mohs hardness	5
Thermal conductivity	6 $Wm^{-1}K^{-1}$
dn/dT	-4,6 × 10^{-6} (||c) K^{-1}, -6,6 × 10^{-6} (||a) K^{-1}
Thermal expansion coefficient	8 × 10^{-6} (||c) K^{-1}, 13 × 10^{-6} (||a) K^{-1}
Typical doping level	1-2 at. %

Standard products

FACE DIMENSIONS	LENGTH	END FACES	ORIENTATION	DOPING	COATINGS	SKU
ø5 mm	10 mm	Right-angle cut	a-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7097
	20 mm	Right-angle cut	a-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7098
	50 mm	Right-angle cut	a-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7099
	100 mm	Right-angle cut	a-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7100
	10 mm	Right-angle cut	c-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7101
	20 mm	Right-angle cut	c-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7102
	50 mm	Right-angle cut	c-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7103
	100 mm	Right-angle cut	c-cut	1%	AR/AR@790-810 nm + 1047-1053 nm	7104



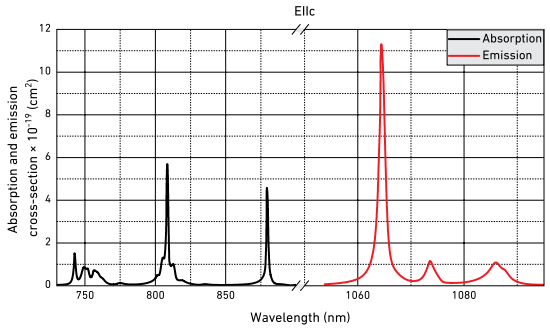
Nd:YVO_4 crystals

Main features

- High absorption and gain cross-sections
- Strongly polarization dependent absorption and emission spectra (π-polarization is preferable)
- Shorter (compared with Nd:YAG) upper-state lifetime
- High optical quality and large diameter boules obtained by Czochralski growth method
- Custom crystals available upon request

Application examples

- High repetition rate Q-switched lasers for marking and engraving
- Mode-locked lasers for spectroscopy and research



Compared to Nd^{3+}:YAG crystals, the Nd^{3+}:YVO_4 crystal has much higher absorption and emission cross-sections, a broader gain bandwidth and wavelength range for pumping, a shorter upper-state lifetime, a higher refractive index, thus it is characterized by a lower thermal conductivity. Nd:YVO_4 crystals are well suited for passively mode-locked lasers with high pulse repetition rates.

A drawback of Nd:YVO_4 lasers is that it is impossible to achieve pulse energies as high as it is achievable with Nd:YAG lasers at Q-switched operation, due to the lower upper-state lifetime and higher gain efficiency. In conclusion, Nd:YVO_4 is better suited as an active medium of high pulse repetition rate Q-switched lasers and CW lasers with a lower lasing threshold.

Standard specifications

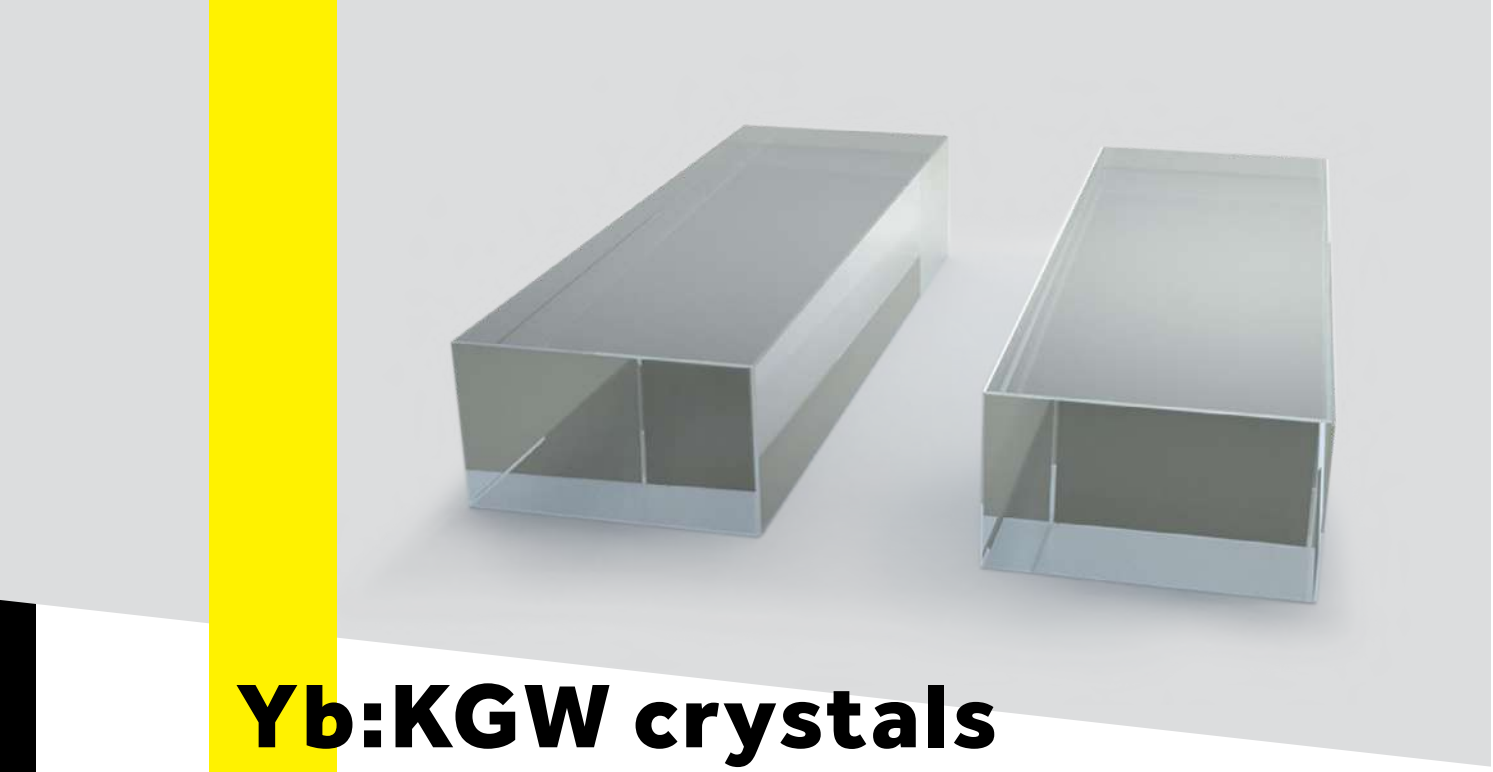
Nd:YVO_4 crystals	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/8@632,8 nm
Coatings	AR(R<0,5%)@808 nm + AR(R<0,15%)@1064 nm and HT(T>95%)@ + HR(R>99,8%)@1064 nm/ AR(R<0,2%)@1064 nm
Laser induced damage threshold	>10 J/cm^2@1064nm, 10 ns
Mount	Unmounted

Properties

Spectroscopic and thermo-mechanical properties	
Absorption peak wavelength	808 nm
Absorption cross-section at peak	5,8 × 10^{-19} cm^2
Absorption bandwidth at peak wavelength	16 nm
Laser wavelength	1064 nm
Lifetime of $^4F_{3/2}$ neodymium energy level	90 µs
Emission cross-section @1064 nm	11,4 × 10^{-19} cm^2
Refractive index @1064 nm	n_o = 1,96, n_e = 2,17
Crystal structure	Tetragonal
Density	4,22 g/cm^3
Mohs hardness	5
Thermal conductivity	~5 $Wm^{-1}K^{-1}$
dn/dT	3,0 × 10^{-6} (∥c) K^{-1}, 8,5 × 10^{-6} (∥a) K^{-1}
Thermal expansion coefficient	11 × 10^{-6} (∥c) K^{-1}, 4,4 × 10^{-6} (∥a) K^{-1}
Typical doping level	0,1-4 at.%

Standard products

Face dimensions	Length	End faces	Doping	Coatings	SKU
3 x 3 mm	5 mm	Right-angle cut	1%	AR/AR@808 nm + 1064 nm	7105
		Right-angle cut	1%	HT@808 nm + HR@1064 nm/AR@1064 nm	7092
	2 mm	Right-angle cut	2%	AR/AR@808 nm + 1064 nm	7089
		Right-angle cut	2%	HT@808 nm + HR@1064 nm/AR@1064 nm	7094
	3 mm	Right-angle cut	2%	AR/AR@808 nm + 1064 nm	7088
		Right-angle cut	2%	HT@808 nm + HR@1064 nm/AR@1064 nm	7093
	0,5 mm	Right-angle cut	3%	AR/AR@808 nm + 1064 nm	7091
		Right-angle cut	3%	HT@808 nm + HR@1064 nm/AR@1064 nm	7096
	1 mm	Right-angle cut	3%	AR/AR@808 nm + 1064 nm	7090
		Right-angle cut	3%	HT@808 nm + HR@1064 nm/AR@1064 nm	7095



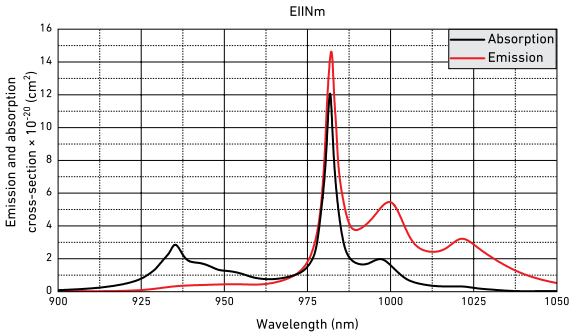
Yb:KGW crystals

Main features

- Large gain bandwidth
- High emission cross-sections
- Small quantum defect
- High doping level
- High thermal conductivity
- Custom crystals available upon request

Application examples

- Femtosecond lasers and regenerative amplifiers
- CW and passively mode-locked thin-disk lasers



Yb^{3+}:KGW crystals possess a large gain bandwidth that enables to obtain <100 fs pulse duration in mode-locked regime of operation. Compared with other ytterbium-doped gain media with a similarly large gain bandwidth, ytterbium-doped tungstate has fairly high emission cross-sections. Ytterbium doping concentration in Yb:KGW crystals can be up to 5 at. % without a significant quenching. Thermal conductivity of common double tungstates is in the range of 3–4 $Wm^{-1}K^{-1}$. Yb:KGW crystals exhibit a small quantum defect and it is possible to operate with a quantum defect well below ~4-5%.

Standard specifications

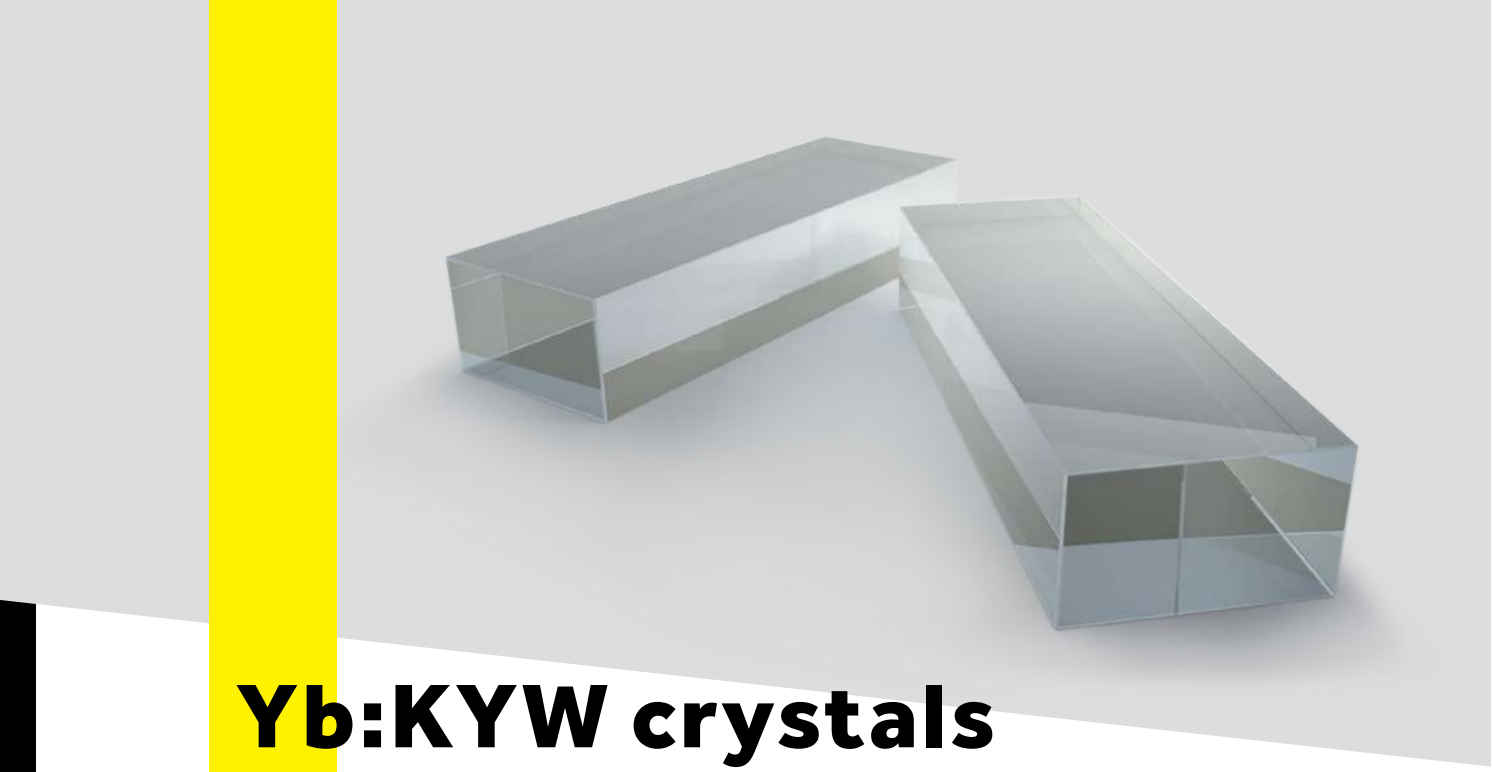
YB:KGW CRYSTALS	
Orientation	Ng-cut; Np(b)-cut and other orientation available
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@970-1070 nm
Laser induced damage threshold	>10 J/cm²@1040 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	980 nm
Absorption cross-section at peak wavelength	12×10^{-20} cm² (E || N_m)
Absorption bandwidth at peak wavelength	3,7 nm
Laser wavelength	1025 (1020-1060) nm
Lifetime of $^2F_{5/2}$ ytterbium energy level	240 µs
Emission cross-section at 1030 nm	3×10^{-20} cm² (E || N_m)
Refractive index at 1064 nm	n_g = 2,037 n_p = 1,986 n_m = 2,033
Crystal structure	Monoclinic
Density	7,25 g/cm³
Mohs hardness	4-5
Thermal conductivity	K_g = 2,6 $Wm^{-1}K^{-1}$ K_p = 3,8 $Wm^{-1}K^{-1}$ K_m = 3,4 $Wm^{-1}K^{-1}$
dn/dT	$dn_g/dT = -15{,}7\times10^{-6}$ K^{-1} $dn_m/dT = -11{,}8\times10^{-6}$ K^{-1} $dn_p/dT = -17{,}3\times10^{-6}$ K^{-1}
Thermal expansion coefficient	α_g = 1,7 × 10^{-6} K^{-1} α_m = 11,01 × 10^{-6} K^{-1} α_p = 17,37 × 10^{-6} K^{-1}
Typical doping level	1-5 at. %

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	10 mm	Brewster-angle cut	1%	Uncoated	7051
	10 mm	Right-angle cut	1%	AR/AR@970-1070 nm	7049
5 x 5 mm	10 mm	Brewster-angle cut	1%	Uncoated	7052
	10 mm	Right-angle cut	1%	AR/AR@970-1070 nm	7050
3 x 3 mm	5 mm	Brewster-angle cut	2%	Uncoated	7055
	5 mm	Right-angle cut	2%	AR/AR@970-1070 nm	7053
5 x 5 mm	5 mm	Brewster-angle cut	2%	Uncoated	7056
	5 mm	Right-angle cut	2%	AR/AR@970-1070 nm	7054
3 x 3 mm	3 mm	Brewster-angle cut	3%	Uncoated	7059
	3 mm	Right-angle cut	3%	AR/AR@970-1070 nm	7057
5 x 5 mm	3 mm	Brewster-angle cut	3%	Uncoated	7060
	3 mm	Right angle cut	3%	AR/AR@970-1070 nm	7058
3 x 3 mm	2 mm	Brewster-angle cut	5%	Uncoated	7063
	2 mm	Right-angle cut	5%	AR/AR@970-1070 nm	7061
5 x 5 mm	2 mm	Brewster-angle cut	5%	Uncoated	7064
	2 mm	Right-angle cut	5%	AR/AR@970-1070 nm	7062



Yb:KYW crystals

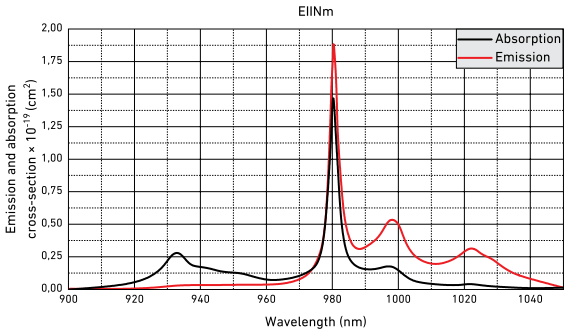
Main features

- Large gain bandwidth
- High emission cross-sections
- Small quantum defect
- High doping level
- High thermal conductivity
- Custom crystals available upon request

Application examples

- Femtosecond lasers and regenerative amplifiers
- CW and passively mode-locked thin-disk lasers

Yb^{3+}:KYW crystals possess a large gain bandwidth that enables to obtain <100 fs pulse duration in mode-locked regime of operation. Compared with other ytterbium-doped gain media with a similarly large gain bandwidth, ytterbium-doped tungstates have fairly high emission cross-sections. Ytterbium doping concentration in Yb:KYW crystals can be very high without a significant quenching. Thermal conductivity of common double tungstates is in the range of 3–4 $Wm^{-1}K^{-1}$. Yb:KYW crystals also feature a small quantum defect.



Standard specifications

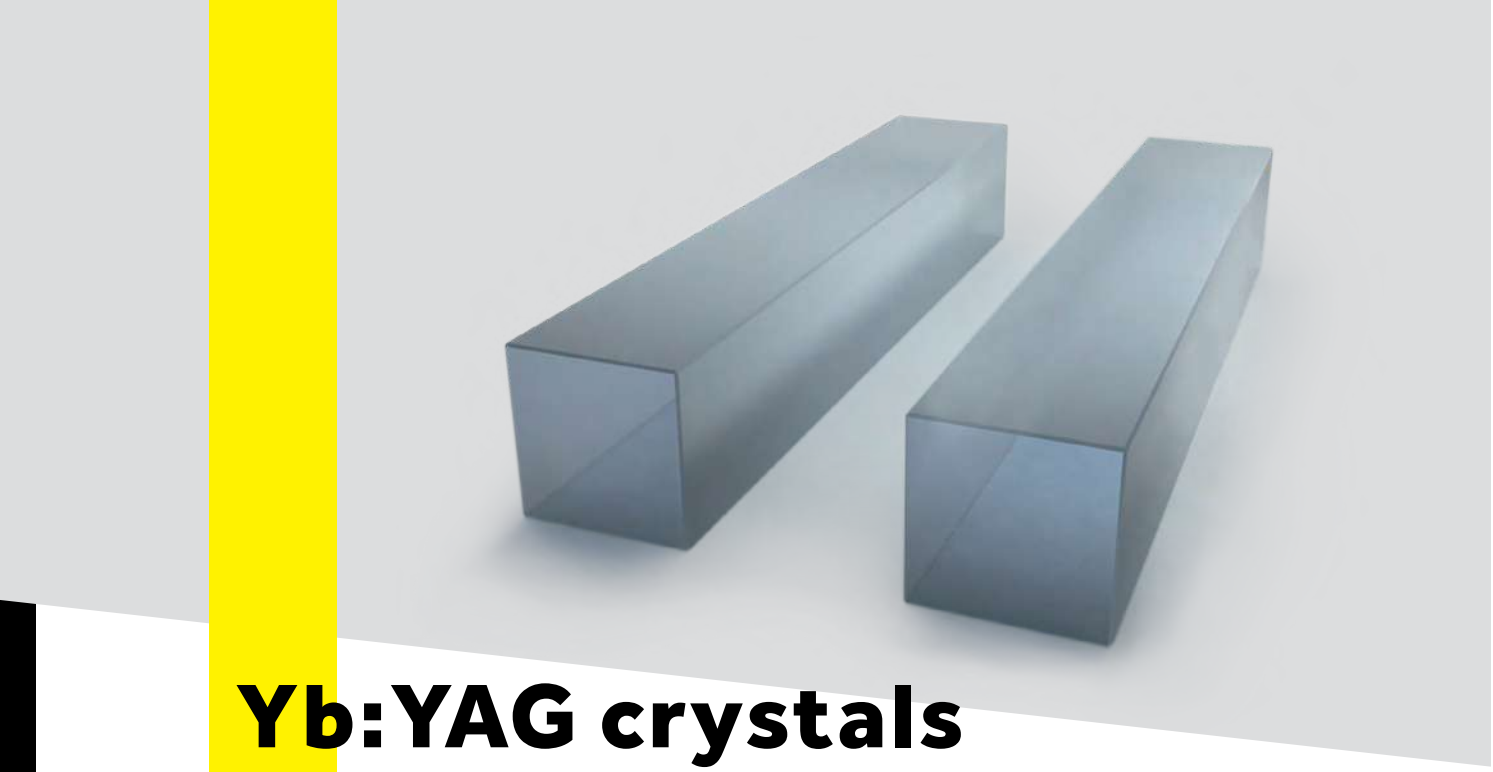
YB:KYW CRYSTALS	
Orientation	Ng-cut; Np(b)-cut and other orientation available
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@970-1070 nm
Laser induced damage threshold	>10 J/cm²@1040 nm, 10 ns
Mount	Uncoated

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	980 nm
Absorption cross-section at peak wavelength	14×10^{-20} cm² (E || N_m)
Absorption bandwidth at peak wavelength	~3 nm
Laser wavelength	1020 (1020-1050) nm
Lifetime of $^2F_{5/2}$ ytterbium energy level	230 µs
Emission cross-section at 1030 nm	$2,5 \times 10^{-20}$ cm² (E || N_m)
Refractive index at 1064 nm	n_g = 2,037 n_p = 1,986 n_m = 2,033
Crystal structure	Monoclinic
Density	6,61 g/cm³
Mohs hardness	4-5
Thermal conductivity	~3,3 Wm-1K⁻¹
dn/dT	$dn_g/dT = -13,08 \times 10^{-6}$ K⁻¹ $dn_m/dT = -7,61 \times 10^{-6}$ K⁻¹ $dn_p/dT = -11,83 \times 10^{-6}$ K⁻¹
Thermal expansion coefficient	α_p = 1,9×10⁻⁶ K⁻¹ α_m = 10,3×10⁻⁶ K⁻¹ α_g = 16,5×10⁻⁶ K⁻¹
Typical doping level	1-100 at. %

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	5 mm	Brewster-angle cut	2%	Uncoated	7037
	5 mm	Right-angle cut	2%	AR/AR@970-1070 nm	7035
5 x 5 mm	5 mm	Brewster-angle cut	2%	Uncoated	7038
	5 mm	Right-angle cut	2%	AR/AR@970-1070 nm	7036
3 x 3 mm	2 mm	Brewster-angle cut	5%	Uncoated	7039
	2 mm	Right-angle cut	5%	AR/AR@970-1070 nm	7041
5 x 5 mm	2 mm	Brewster-angle cut	5%	Uncoated	7042
	2 mm	Right-angle cut	5%	AR/AR@970-1070 nm	7040
3 x 3 mm	1 mm	Brewster-angle cut	10%	Uncoated	7045
	1 mm	Right-angle cut	10%	AR/AR@970-1070 nm	7043
5 x 5 mm	1 mm	Brewster-angle cut	10%	Uncoated	7046
	1 mm	Right-angle cut	10%	AR/AR@970-1070 nm	7044



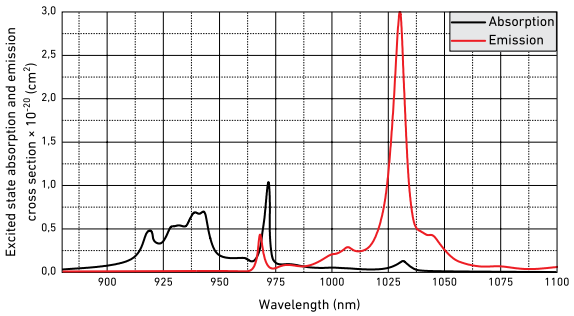
Yb:YAG crystals

Main features

- Simple electronic structure excludes excited-state absorption and also a variety of detrimental quenching processes
- Broad absorption band at 940 nm
- Long lifetime of the $^2F_{5/2}$ ytterbium energy level
- Low quantum defect
- Custom crystals available upon request

Application examples

- Material processing, micromachining, welding, cutting
- Efficient high power thin-disk lasers



Yb^{3+}:YAG crystals feature a 950 us lifetime of the $^2F_{5/2}$ ytterbium energy level and a quantum defect of only ~9%. Yb:YAG crystals also possess a broad pump band at near 940 nm that is more than 10 times broader than the 808 nm pump line of Nd:YAG crystals. It makes Yb:YAG systems less sensitive to thermal shift of pump diodes wavelength. Yb:YAG lasers emit typically at either 1030 nm (strongest line) or 1050 nm. It is often used in powerful and efficient thin-disk lasers.

Standard specifications

YB:YAG CRYSTALS	
Orientation	[111]
Extinction ratio	>28 dB
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,15 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/10@632,8 nm
Wavefront distortion	λ/4@632,8 nm
Coatings	AR(R<0,5%)@940 nm + AR(R<0,2%)@1030 nm on both faces
Laser induced damage threshold	>10 J/cm²@1030 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	942 nm
Absorption cross-section at peak wavelength	$7,7 \times 10^{-21}$ cm²
Absorption bandwidth at peak wavelength	18 nm
Laser wavelength	1030 nm
Lifetime of $^2F_{5/2}$ ytterbium energy level	950 µs
Emission cross-section @1030 nm	$2,1 \times 10^{-20}$ cm²
Refractive index @632,8 nm	1,83
Crystal structure	Cubic
Density	4,56 g/cm³
Mohs hardness	8,5
Thermal conductivity	~13 $Wm^{-1} K^{-1}$
dn/dT	$7,8 \times 10^{-6} K^{-1}$
Thermal expansion coefficient	$6,2 \times 10^{-6} K^{-1}$
Typical doping level	1-20 at. %

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
5 x 5 mm	10 mm	Brewster-angle cut	1%	Uncoated	6664
		Right-angle cut	1%	AR/AR@940 nm + 1030 nm	6661
	2 mm	Brewster-angle cut	5%	Uncoated	6663
		Right-angle cut	5%	AR/AR@940 nm + 1030 nm	6660
	1 mm	Brewster-angle cut	10%	Uncoated	6662
		Right-angle cut	10%	AR/AR@940 nm + 1030 nm	6659

Yb:CaF_2 crystals

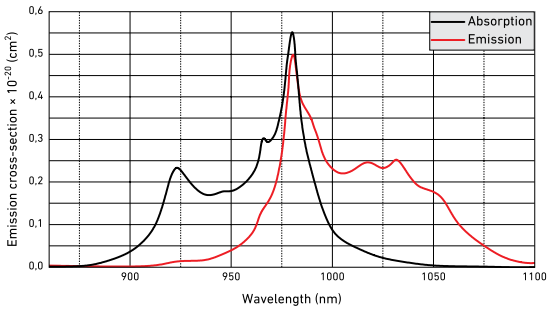
Main features

- Isotropic crystal (cubic symmetry)
- Low quantum defect
- Long lifetime of the $^2F_{5/2}$ ytterbium energy level
- Wide optical transmission
- Low dispersion behavior
- Limited nonlinear effects under intense laser irradiation
- Custom crystals available upon request

Application examples

- Diode-pumped femtosecond solid-state lasers aiming at the generation of high-energy pulses
- Ultrashort pulses with high average power

Yb^{3+}:CaF_2 are among most studied and promising crystals for the development of short-pulse, high-energy, high-power diode-pumped solid-state lasers. There are several reasons that explain this trend. Firstly, calcium fluoride is a simple cubic crystal whose crystallographic properties are fairly well known. Moreover, this crystal can be grown of large dimension and optical quality. The simple structure of this crystal contributes to its good thermal properties. Finally, Yb-doped calcium fluorides feature very broad and smooth emission bands, which is exceptional for cubic crystals.



Standard specifications

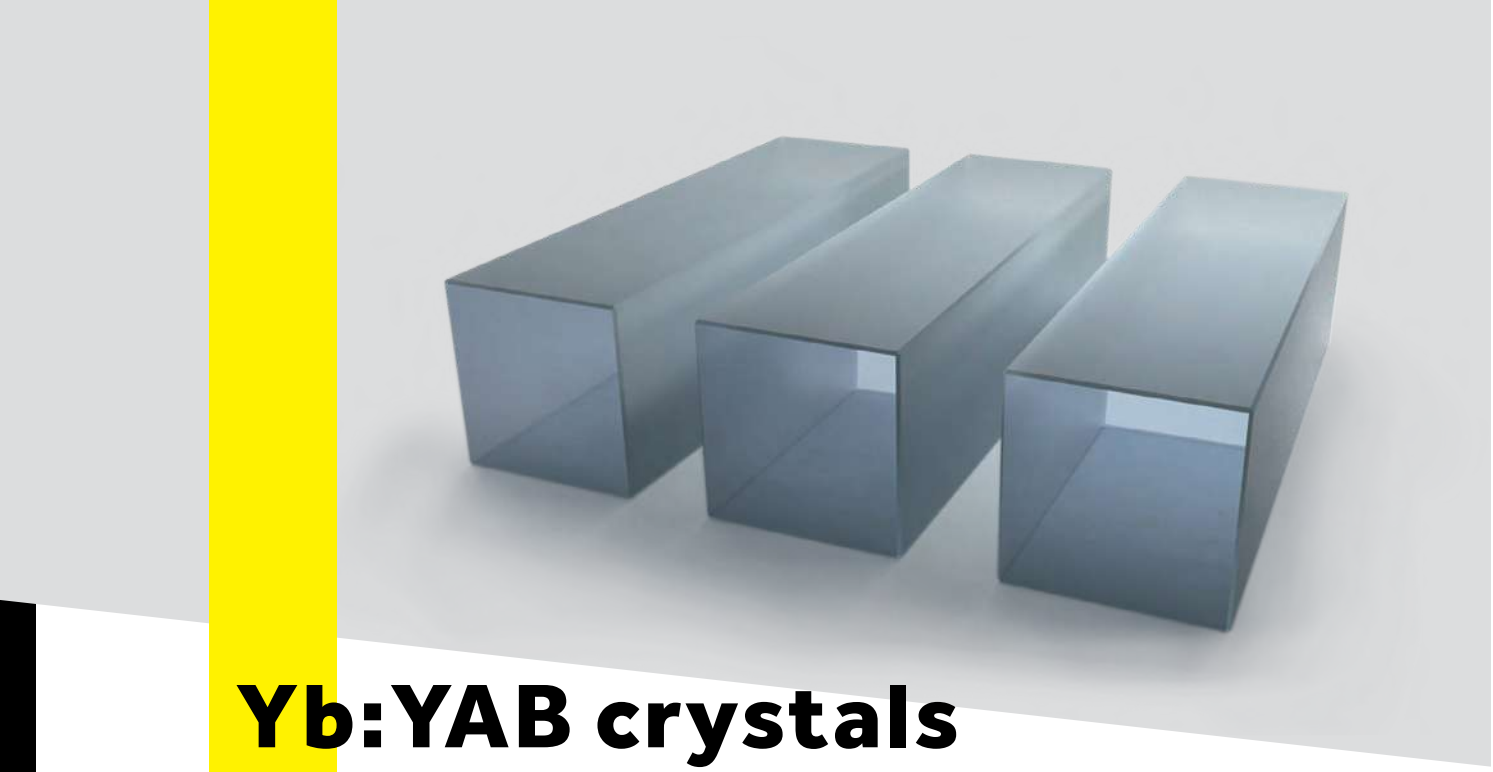
YB:CAF_2 CRYSTALS	
Orientation	[111]
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,15 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@980 nm + AR(R< 0,2%)@1040-1070 nm
Laser induced damage threshold	>10 J/cm^2@1040 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	976 nm
Absorption cross-section at peak	0,54 × 10^{-20} cm^2
Laser wavelength	1020-1060 nm
Lifetime of $^2F_{5/2}$ energy level	2,4 ms
Emission cross-section @1053 nm	0,16 × 10^{-20} cm^2
Refractive index @1040nm	1,43
Crystal structure	cubic
Density	3,18 g/cm^3
Mohs hardness	4
Thermal conductivity	5,4 $Wm^{-1}K^{-1}$
dn/dT	-11,3 × 10^{-6} K^{-1}
Thermal expansion coefficient	18,9 × 10^{-6} K^{-1}
Typical doping level	1-5 at. %

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
ø3 mm	10 mm	Brewster-angle cut	1%	Uncoated	7032
		Right-angle cut	1%	AR/AR@980 nm + 1040-1070 nm	7029
	5 mm	Brewster-angle cut	3%	Uncoated	7031
		Right-angle cut	3%	AR/AR@980 nm + 1040-1070 nm	7028
	3 mm	Brewster-angle cut	5%	Uncoated	7030
		Right-angle cut	5%	AR/AR@980 nm + 1040-1070 nm	7027



Yb:YAB crystals

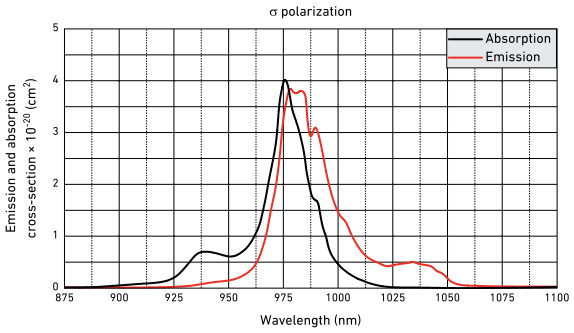
Main features

- Self-doubling laser crystal
- High thermal conductivity
- Wide absorption bandwidth near 976 nm
- High absorption and emission cross-sections
- Low quantum defect
- Custom crystals available upon request

Application examples

- High power CW lasers
- Mode-locked femtosecond lasers
- CW and mode-locked self-doubling lasers

Yb^{3+}:YAB is one of the few representatives with multifunctional properties: as a negative uniaxial crystal, it also possesses nonlinear optical properties, permitting a direct conversion of the infrared radiation to the visible through second order nonlinear processes. High concentrations of Yb^{3+} ions can be included in the YAB crystal matrix with little concentration quenching. Yb:YAB crystals feature good mechanical strength, good thermal conductivity, and stable chemical characteristics.



Standard specifications

YB:YAB CRYSTALS	
Orientation	c-cut, a-cut available
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	Antireflective (AR) coatings on both faces
Laser induced damage threshold	>10 J/cm²@1030 nm, 10 ns (for AR/AR@960-1060 nm coatings)
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	976 nm
Absorption cross-section at peak	$3,8 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	20 nm
Laser wavelength	1040 nm
Lifetime of $^2F_{5/2}$ energy level	680 µs
Emission cross-section @1040 nm	$0,5 \times 10^{-20}$ cm²
Refractive index @632.8 nm	n_o=1,7757, n_e=1,7015
Crystal structure	Trigonal
Density	3,84 g/cm³
Mohs hardness	7,5
Thermal conductivity	~6 $Wm^{-1}K^{-1}$
dn/dT	$1,4 \times 10^{-6}$ (IIa) K^{-1}, $4,8 \times 10^{-6}$ (IIc) K^{-1}
Thermal expansion coefficient	2×10^{-6} (IIa) K^{-1}, $9,5 \times 10^{-6}$ (IIc) K^{-1}
Typical doping level	10 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	ORIENTATION	DOPING	COATINGS	SKU
3 x 3 mm	2 mm	Right-angle cut	c-cut	10%	AR/AR@960-1060 nm	12826
		Brewster-angle cut	c-cut	10%	Uncoated	12827
		Right-angle cut	θ = 31°, φ = 0°	10%	AR/AR@520+976+1040 nm	12828

Yb:YAP crystals

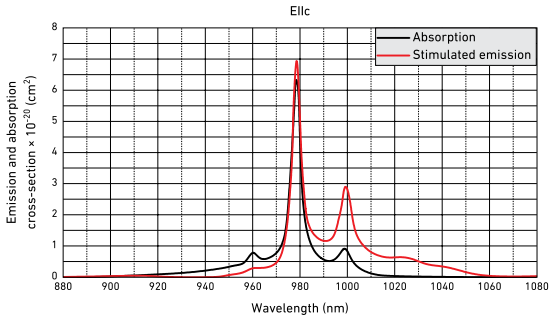
Main features

- Biaxial orthorhombic crystal
- High absorption cross-section dependent upon the crystallographic orientation
- High thermal conductivity
- Low quantum defect
- Custom crystals available upon request

Application examples

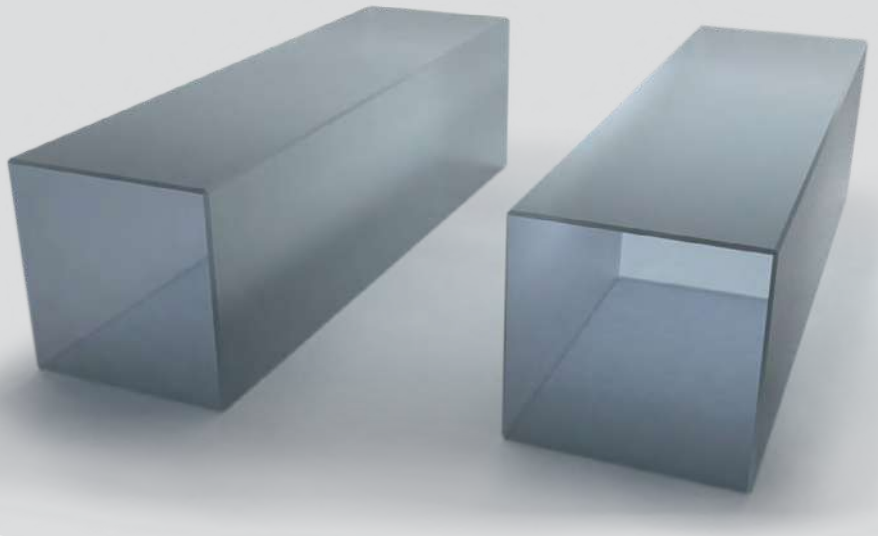
- Femtosecond lasers and regenerative amplifiers
- CW and passively mode-locked thin-disk lasers

Yttrium aluminate doped with Yb^{3+}, (Yb^{3+}:YAP) is a biaxial orthorhombic crystal. YAP crystal hardness and thermal conductivity are similar to YAG but exhibits a highly anisotropic thermal expansion coefficient and is birefringent. Emission wavelengths are polarized, while emission and absorption cross-sections are strongly dependent upon the crystallographic orientation. The absorption cross-sections of the Yb:YAP crystal is higher than that of the Yb:YAG crystal.



Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	978 nm
Absorption cross-section at peak	6,6 × 10^{-20} cm^2
Absorption bandwidth at peak wavelength	4 nm
Laser wavelength	1040 nm
Lifetime of $^2F_{5/2}$ energy level	500 µs
Emission cross-section @1040 nm	0,5 × 10^{-20} cm^2
Refractive index @632.8 nm	1,96 (IIa), 1,94 (IIb), 1,97 (IIc)
Crystal structure	orthorhombic
Density	5,35 g/cm^3
Mohs hardness	8,5
Thermal conductivity	11,7 (||a), 10,0 (||b), 13,3 (||c) $Wm^{-1}K^{-1}$
dn/dT	7,7 × 10^{-6} (IIa) K^{-1}, 11,7 × 10^{-6} (IIb) K^{-1}, 8,3 × 10^{-6} (IIc) K^{-1}
Thermal expansion coefficient	2,32 × 10^{-6} (IIa) K^{-1}, 8,08 × 10^{-6} (IIb) K^{-1}, 8,7 × 10^{-6} (IIc) K^{-1}
Typical doping level	<2 at.%



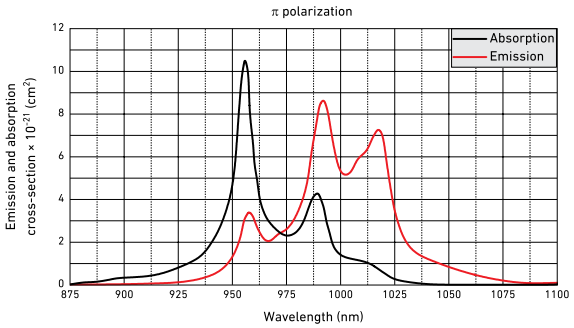
Yb:YLF crystals

Main features

- Simple electronic structure excludes excited-state absorption and also a variety of detrimental quenching processes
- Broad and smooth emission spectrum
- Wide tunning range
- Absorption spectra are well matched with the emission wavelength of InGaAs laser diodes
- Low quantum defect
- Custom crystals available upon request

Application examples

- Diode-pumped mode-locked lasers
- Thin-disk lasers



Standard specifications

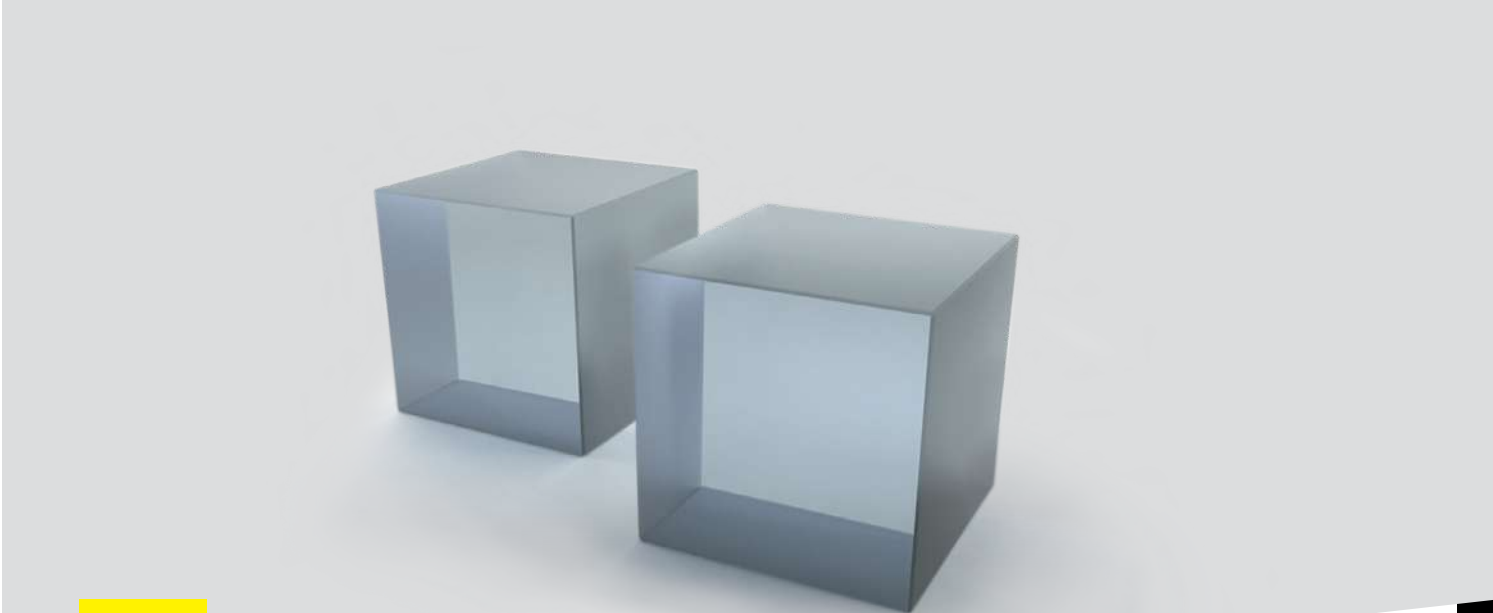
YB:YLF CRYSTALS	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@960 nm + AR(R< 0,2%) @1000-1060 nm on both faces
Laser induced damage threshold	>10 J/cm²@1030 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	960 nm
Absorption cross-section at peak	$10{,}5 \times 10^{-21}$ cm²
Absorption bandwidth at peak wavelength	~10 nm
Laser wavelength	1017 nm
Lifetime of $^2F_{5/2}$ energy level	2,1 ms
Emission cross-section @1053 nm	$4{,}1 \times 10^{-21}$ cm²
Refractive index @1040nm	~1,4
Crystal structure	tetragonal
Density	3,95 g/cm³
Mohs hardness	5
Thermal conductivity	6 $Wm^{-1}K^{-1}$
dn/dT	$-4{,}6 \times 10^{-6}$ (IIc) K^{-1}, $-6{,}6 \times 10^{-6}$ (IIa) K^{-1}
Thermal expansion coefficient	8×10^{-6} (IIc) K^{-1}, 13×10^{-6} (IIa) K^{-1}
Typical doping level	5-20 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	8 mm	Right-angle cut	5%	AR/AR@960 nm + 1000-1060 nm	7828
3 x 3 mm	8 mm	Brewster-angle cut	5%	Uncoated	7829
ø8 mm	8 mm	Right-angle cut	5%	AR/AR@960 nm + 1000-1060 nm	7830
3 x 3 mm	4 mm	Brewster-angle cut	10%	Uncoated	7832
3 x 3 mm	4 mm	Right-angle cut	10%	AR/AR@960 nm + 1000-1060 nm	7831
ø8 mm	4 mm	Right-angle cut	10%	AR/AR@960 nm + 1000-1060 nm	7833
3 x 3 mm	2 mm	Brewster-angle cut	20%	Uncoated	7835
3 x 3 mm	2 mm	Right-angle cut	20%	AR/AR@960 nm + 1000-1060 nm	7834
ø8 mm	2 mm	Right-angle cut	20%	AR/AR@960 nm + 1000-1060 nm	7836



Yb:YVO_4 crystals

Main features

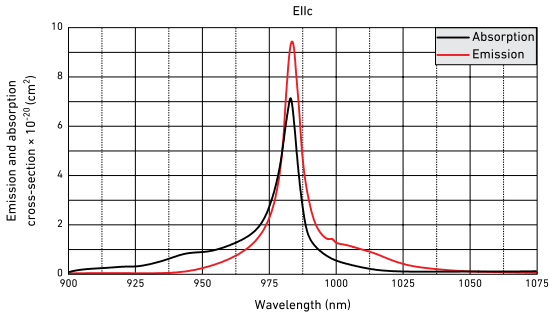
- The simple electronic structure excludes excited-state absorption and also a variety of detrimental quenching processes
- Broad and smooth emission spectrum
- Low quantum defect
- Custom crystals available upon request

Application examples

- High power CW, Q-switched and mode-locked lasers
- Thin-disk lasers

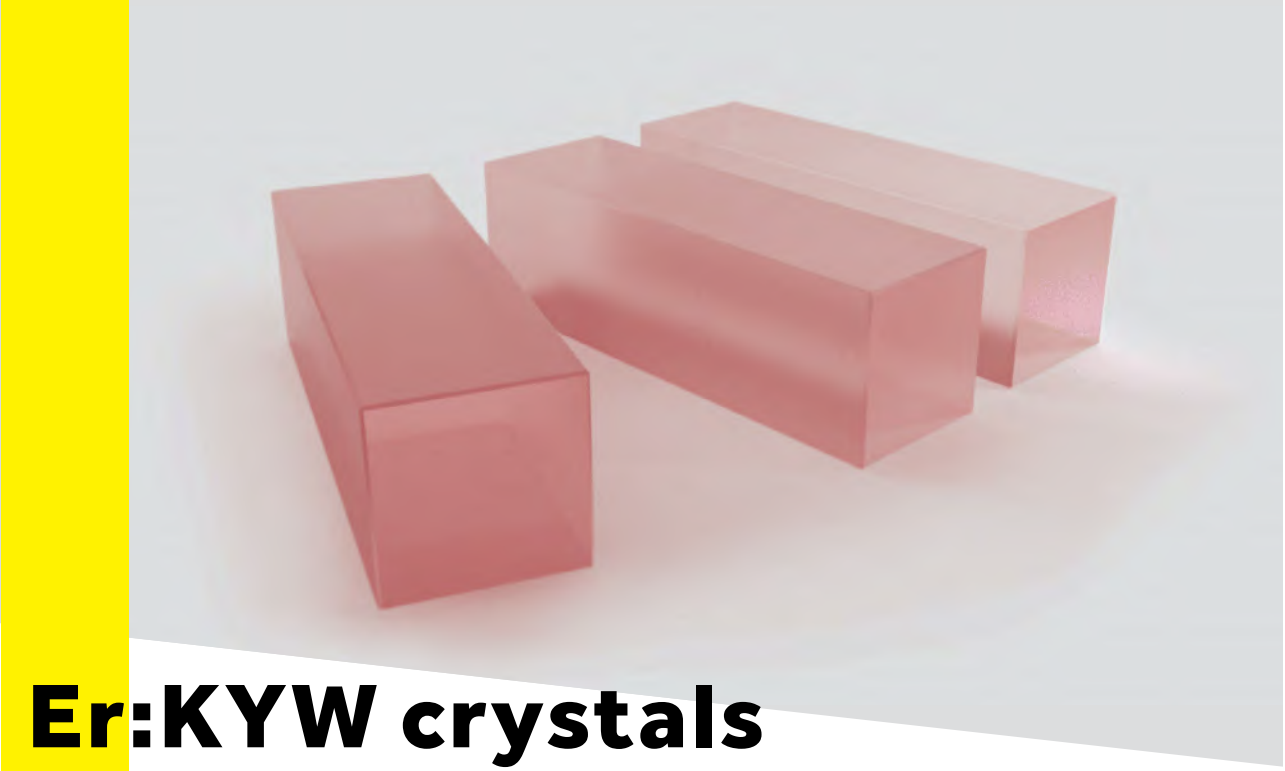
Optogama does not provide standard product list. Please contact us for solutions and pricing.

Yb^{3+}:YVO_4 crystal has a broad and smooth emission spectrum that allows wide wavelength tuning ranges and generating ultrashort pulses in mode-locked lasers. Due to good thermal conductivity Yb:YVO_4 crystals can be used as an active medium in high-power thin-disk lasers.



Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	985 nm
Absorption cross-section at peak	7,5 × 10^{-20} cm^2
Absorption bandwidth at peak wavelength	5 nm
Laser wavelength	1027 nm
Lifetime of $^2F_{5/2}$ ytterbium energy level	250 µs
Emission cross-section @1027 nm	0,5 × 10^{-20} cm^2
Refractive index @1064 nm	n_o = 1,93, n_e = 2,1
Crystal structure	Tetragonal
Density	4,22 g/cm^3
Mohs hardness	5
Thermal conductivity	~5 $Wm^{-1}K^{-1}$
dn/dT	8,41 × 10^{-6} (IIc) K^{-1}, 15,5 × 10^{-6} ((IIa) K^{-1}
Thermal expansion coefficient	1,5 × 10^{-6} (IIa) K^{-1}, 8,2 × 10^{-6} (IIc) K^{-1}
Typical doping level	1-3 at.%



Er:KYW crystals

Main features

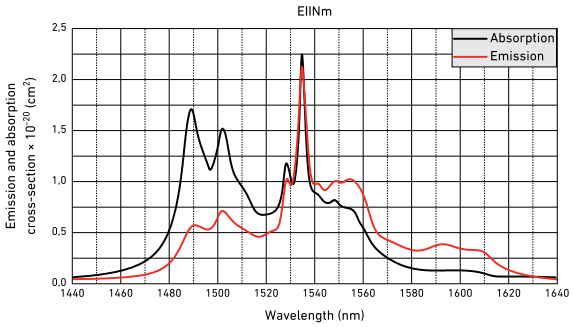
- Strong absorption bandwidth near 1534 nm corresponding to InGaAsP/InP laser diode emission
- Wide emission bandwidth near 1600 nm
- Custom crystals available upon request

Application examples

- In-band pumped "eye-safe" CW, Q-switched and mode-locked lasers
- In-band pumped "eye-safe" waveguide lasers

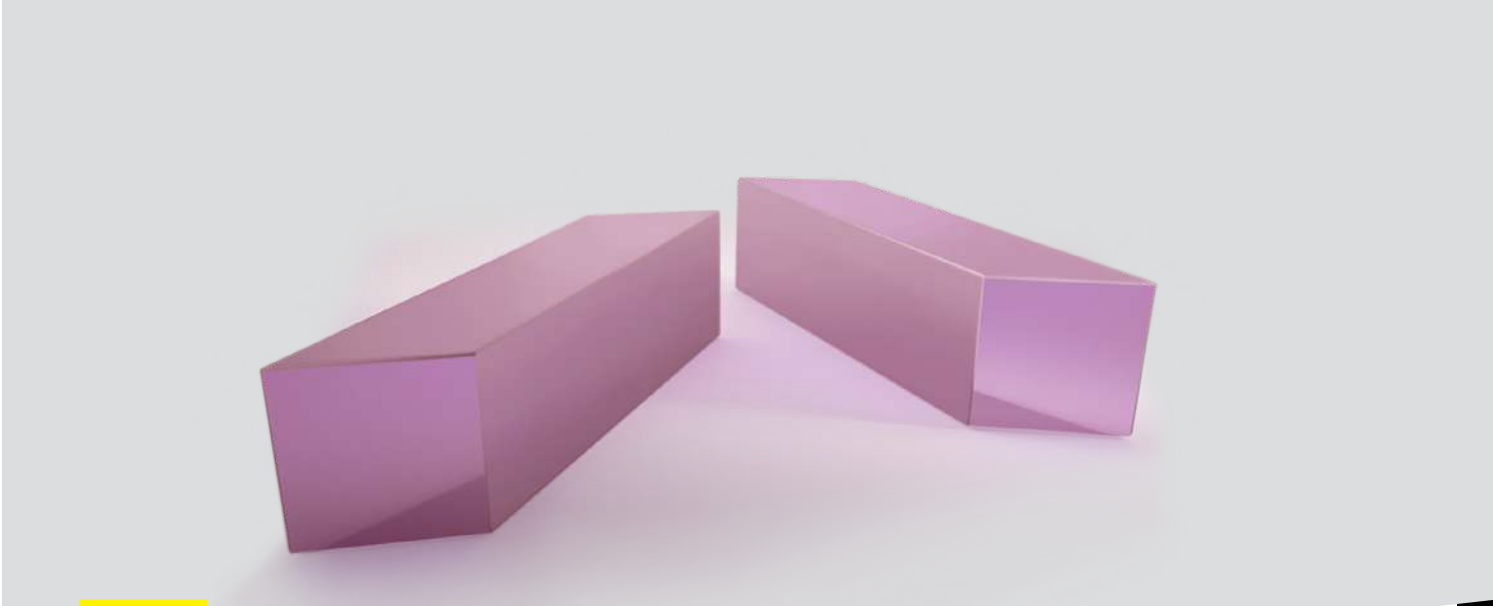
Optogama does not provide standard product list. Please contact us for solutions and pricing.

Er^{3+}:KYW is a promising laser material for eye-safe emission at the wavelength of 1609 nm, which can be resonantly diode-pumped into the upper laser manifold at 1534 nm. Due to the low quantum defect high-slope efficiencies of >80% can be achieved with direct fiber laser or InGaAs/InP pumping. Because of a broad and smooth emission in the spectral range of 1570-1630 nm mode-locked "eye-safe" laser can be realized.



Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	1534 nm
Absorption cross-section at peak	$2,4 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	3 nm
Laser wavelength	1609 nm
Lifetime of $^4I_{13/2}$ erbium energy level	3,1 ms
Emission cross-section @1609 nm	$0,4 \times 10^{-20}$ cm²
Refractive index	$n_g = 2,05$, $n_m = 2,01$, $n_p = 1,97$
Crystal structure	Monoclinic
Density	6,5 g/cm³
Mohs hardness	4-5
Thermal conductivity	~3,5 $Wm^{-1}K^{-1}$
Typical doping level	<20 at. %



Er:YAG crystals

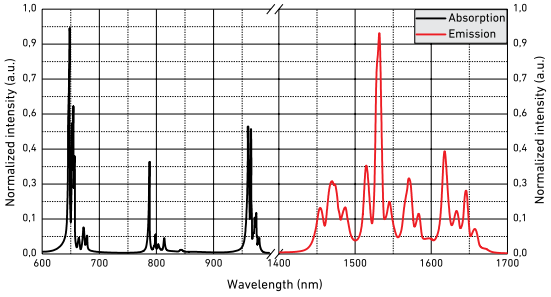
Main features

- Isotropic crystal (cubic symmetry)
- High thermal conductivity
- Strong absorption bandwidth near 1470 nm corresponding to InGaAsP/InP laser diode emission
- Emission spectra at 1617 nm is free from absorption in the atmosphere
- Custom crystals available upon request

Application examples

- CW and Q-switched eye-safe (~1,6 µm) in-band pumped lasers with nearly quantum defect limited efficiency for military applications including LIDAR, telemetry, or active imaging
- Channel waveguide eye-safe (~1,6 µm) in-band pumped lasers with diffraction-limited output for long-distance telemetry and ranging
- CW and Q-switched ~3 µm lasers for oral surgery, dentistry, implant dentistry, and otolaryngology

Er^{3+}:YAG crystal is an attractive laser material for eye-safe emission at wavelengths of 1617 and 1645 nm which can be resonantly diode-pumped into the upper laser manifold at 1470 nm and 1532 nm. Due to the low quantum defect high slope efficiencies of >80% can be achieved with direct fiber laser or InGaAs/InP pumping. By using heavily erbium doped (~50 at.%) YAG crystal efficient CW laser operation at ~3 µm can be obtained.



Standard specifications

ER:YAG CRYSTALS	
Orientation	[111]
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	Uncoated, coatings available upon request
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	960, 1470, 1532 nm
Absorption cross-section at peak wavelength	~1,0 × 10^{-20} cm^2@1470 nm
Absorption bandwidth at peak wavelength	~2-3 nm @ 1470 nm
Laser wavelength	1617, 1645, 2940 nm
Lifetime of $^4I_{13/2}$ and $I_{11/2}$ erbium energy level	6,0 ms ($^4I_{13/2}$), 0,1 ms ($I_{11/2}$)
Emission cross-section at wavelength	2,6 × 10^{-20}@2940 nm 5,2 × 10^{-21}@1645 nm
Refractive index @1064 nm	1,82
Crystal structure	Cubic
Density	4,56 g/cm^3
Mohs hardness	8,5
Thermal conductivity	~13 $Wm^{-1}K^{-1}$
dn/dT @1064 nm	7,8 × 10^{-6} K^{-1}
Thermal expansion coefficient	~7 × 10^{-6} K^{-1}
Typical doping level	<1 at.% (for ~1,6 µm lasers) <50 at.% (for ~3 µm lasers)

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
5 x 5 mm	3 mm	Brewster-angle cut	0,15%	Uncoated	7852
	2 mm	Brewster-angle cut	50%	Uncoated	7853

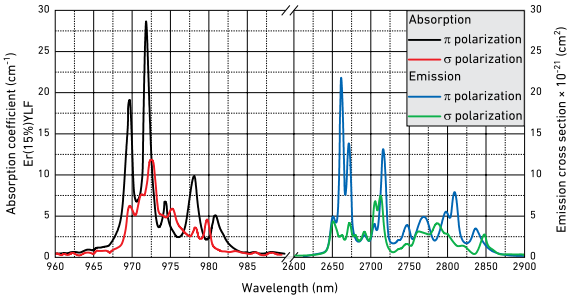
Er:YLF crystals

Main features

- A low phonon frequency
- Long lifetimes of the laser emitting levels
- Wide transparency range (from the VUV to the 10 µm region)
- Negative thermo-optic coefficient
- Custom crystals available upon request

Application examples

- CW and Q-switched ~3 µm lasers for oral surgery, dentistry, implant dentistry, and otolaryngology
- Up-conversion visible lasers for display technology, medicine (diagnosis and treatment)



Er^{3+}:YLF crystals are characterized by a low phonon frequency, which decreases the probability of non-radiative multi-phonon relaxations, therefore increases the luminescence quantum efficiency. Long lifetime of laser emitting levels allow higher energy storage, which is useful for the Q-switch lasing regime. High bandgap along with a low phonon energy leads to a very wide transparency range, which is possibly from VUV to 10 µm region. Negative Er^{3+}:YLF thermo-optic coefficient is an advantage since it reduces the thermal-lensing effect and improves beam shape as well as stability at high average pump power.

Standard specifications

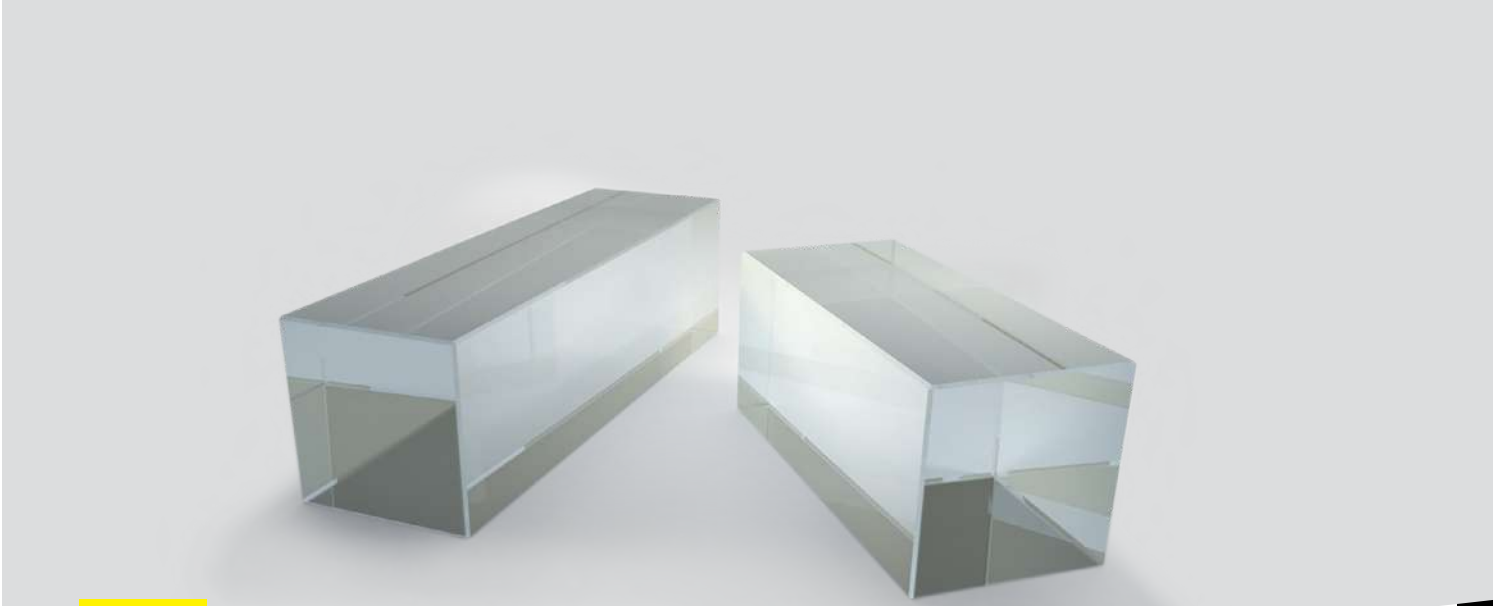
ER:YLF CRYSTALS	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	Uncoated, coatings available upon request
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	972 nm
Absorption coefficient at peak wavelength	28 cm^{-1}
Absorption bandwidth at peak wavelength	~1 nm
Laser wavelength	2810 nm
Lifetime of $^4I_{11/2}$ erbium energy level	4 ms
Emission cross-section @2800 nm	1,5 × 10^{-20} cm^2
Refractive index @2070 nm	n_o = 1,442, n_e = 1,464
Crystal structure	tetragonal
Density	3,95 g/cm^3
Mohs hardness	5
Thermal conductivity	~5 $Wm^{-1}K^{-1}$
dn/dT	-2 × 10^{-6} (IIa) K^{-1}, -4,1×10^{-6} (IIc) K^{-1}
Thermal expansion coefficient	8 × 10^{-6} K^{-1}
Typical doping level	15 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
ø5 mm	5 mm	Brewster-angle cut	15%	Uncoated	7843
5 x 5 mm	5 mm	Brewster-angle cut	15%	Uncoated	7842



Er,Yb:phosphate glass

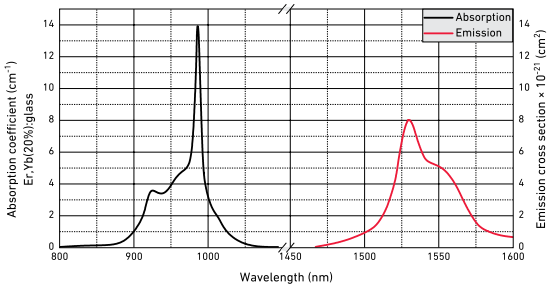
Main features

- Long lifetime of the $^4I_{13/2}$ erbium energy level
- High Yb to Er energy transfer efficiency
- High absorption and emission cross-sections
- Wide absorption and emission bandwidths
- Custom crystals available upon request

Application examples

- Passively Q-switched lasers for laser rangefinders, LIDAR, and LIBS systems

Er^{3+},Yb^{3+} co-doped phosphate glass (Er,Yb:phosphate glass) is a well-known and commonly used active medium for lasers emitting in the "eye-safe" spectral range of 1,5-1,6 µm. Phosphate glass combines a long lifetime (~8 ms) of $^4I_{13/2}$ Er^{3+} upper laser level with a low (2–3 ms) lifetime of $^4I_{11/2}$$Er^{3+}$ level that is in resonance with Yb^{3+} $^2F_{5/2}$ excited state. Fast non-radiative multi-phonon relaxation from $^4I_{11/2}$ to $^4I_{13/2}$ level greatly decreases the back-energy transfer and up-conversion losses due to the interaction between Yb^{3+} and Er^{3+} ions, excited at the $^2F_{5/2}$ and the $^4I_{11/2}$ levels, respectively.



Standard specifications

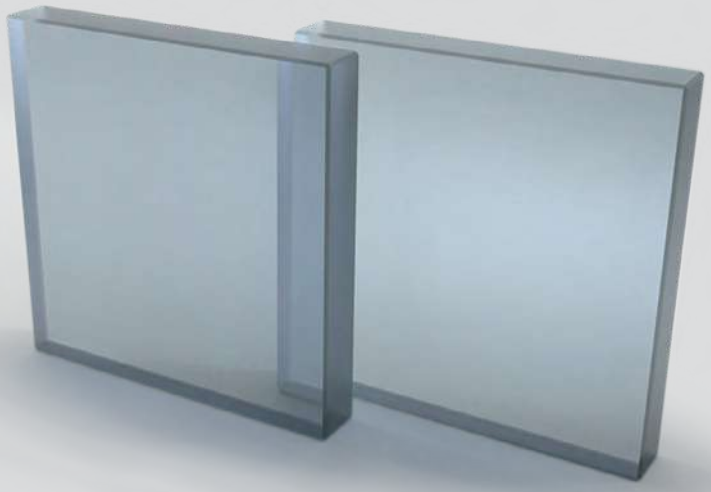
ER, YB:PHOSPHATE GLASS ELEMENTS	
Clear aperture	>90%
Face dimensions tolerance	+0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@940 nm + AR(R<0,2%) @1535 nm on both faces
Laser induced damage threshold	>10 J/cm²@1535 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	970 nm
Absorption cross-section at peak wavelength	$1,7 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	20 nm
Laser wavelength	1534 nm
Lifetime of $^4I_{13/2}$ erbium energy level	7,9 ms
Emission cross-section @1534 nm	8×10^{-21} cm²
Yb to Er energy transfer efficiency	>90 %
Refractive index @1534 nm	1,52
Crystal structure	-
Density	2,93 g/cm³
Mohs hardness	6-7
Thermal conductivity	0,85 $Wm^{-1}K^{-1}$
dn/dT	$-2,1 \times 10^{-6}$ K^{-1}
Thermal expansion coefficient	$12,4 \times 10^{-6}$ K^{-1}
Typical doping level	$0,3\text{-}1,3 \times 10^{20}$ cm^{-3} [Er] $1,7\text{-}4 \times 10^{21}$ cm^{-3} [Yb]

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	5 mm	Brewster-angle cut	Yb 20%, Er 1%	Uncoated	7824
		Right-angle cut	Yb 20%, Er 1%	AR/AR@940 nm + 1535 nm	7823
	10 mm	Brewster-angle cut	Yb 20%, Er 0,5%	Uncoated	7822
		Right-angle cut	Yb 20%, Er 0,5%	AR/AR@940 nm + 1535 nm	7821



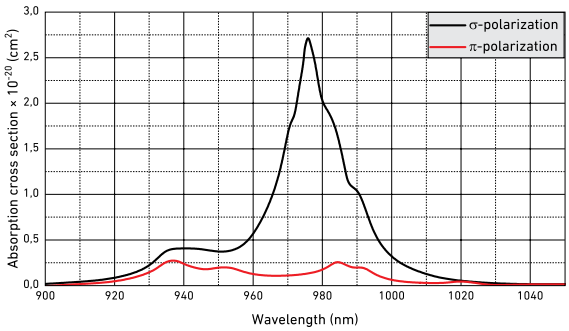
Er, Yb:YAB crystals

Main features

- Uniaxial crystal with trigonal structure
- High thermal conductivity
- Wide absorption bandwidth near 976 nm
- High absorption and emission cross-sections
- Extremely high Yb^{3+} to Er^{3+} energy transfer efficiency

Application examples

- High power eye-safe (~1,5 µm) CW lasers for metrology
- High-repetition rate passively Q-switched lasers for LIDAR and LIBS systems
- Ultrashort mode-locked lasers for telecom systems



Er^{3+}, Yb^{3+} co-doped yttrium-aluminum borate (Er, Yb:YAB) crystal is an alternative to commonly used Er,Yb:phosphate glass as an active medium of "eye-safe" (1,5-1,6 µm) lasers with a high average output power in CW and pulsed modes. It is characterized by high thermal conductivities of 7,7 $Wm^{-1}K^{-1}$ and 6 $Wm^{-1}K^{-1}$ along a-axis and c-axis, respectively.

It also features a highly effective Yb^{3+} to Er^{3+} energy transfer (~94%) and weak up conversion losses due to the very short lifetime of $^4I_{11/2}$ excited state (~80 ns) facilitated by a high maximum phonon energy of the host material (hv_{max} ~1500 cm^{-1}). A strong and wide (~17 nm) absorption band is observed at 976 nm that coincides with the emission spectrum of InGaAs laser diodes.

Standard specifications

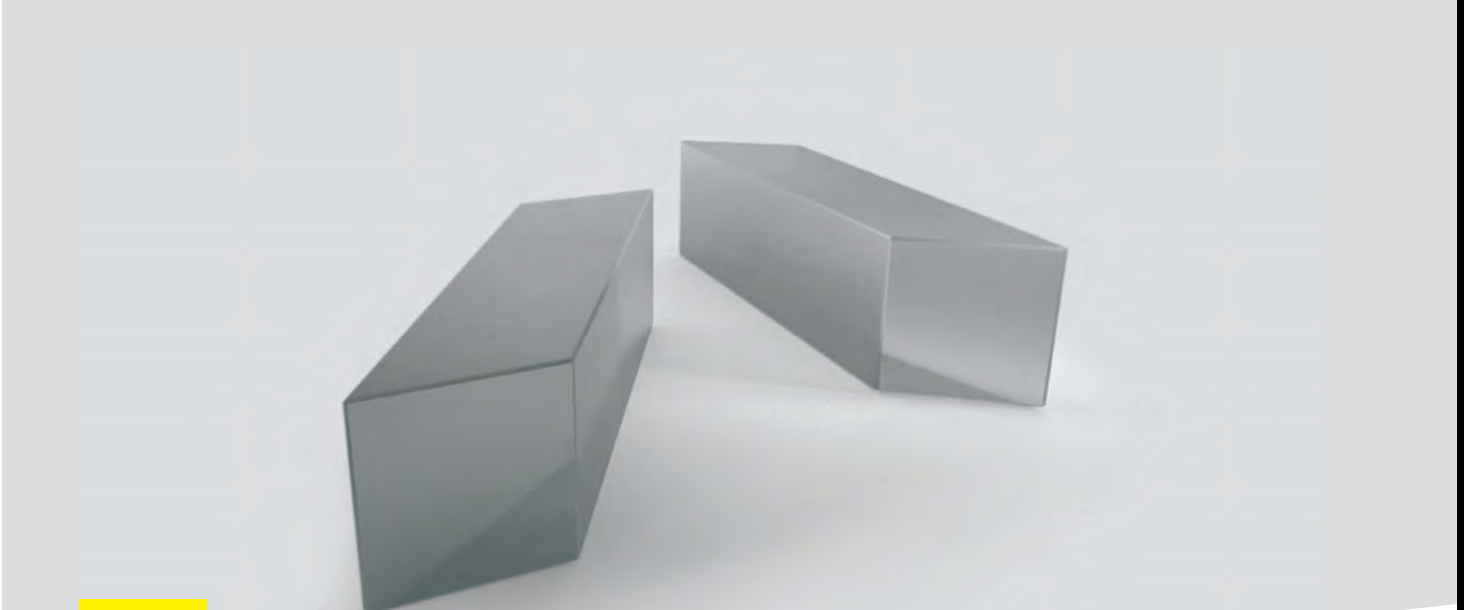
ER, YB:YAB CRYSTALS	
Orientation	c-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,15 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR@(R<1%)@940 nm + AR(R<0,25%)@1480-1600 nm
Laser induced damage threshold	>10 J/cm²@1550 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	976 nm
Absorption cross-section at peak wavelength	$2,7 \times 10^{-20}$ cm^2
Absorption bandwidth at peak wavelength	17 nm
Laser wavelength	1522, 1531, 1543, 1550, 1602 nm
Lifetime of $^4I_{13/2}$ erbium energy level	0,32 ms
Emission cross-section @1531 nm	$2,5 \times 10^{-20}$ cm^2
Yb to Er energy transfer efficiency	>90 %
Refractive index @632.8 nm	n_o = 1,7757, n_e = 1,7015
Crystal structure	trigonal
Density	3,84 g/cm^3
Mohs hardness	7,5
Thermal conductivity	7,7 (IIa), 6 (IIc) $Wm^{-1}K^{-1}$
dn/dT	$1,4 \times 10^{-6}$ (IIa), $4,8 \times 10^{-6}$ (IIc) K^{-1}
Thermal expansion coefficient	2×10^{-6} (IIa), $9,5 \times 10^{-6}$ (IIc) K^{-1}
Typical doping level	1-2 at.% [Er] 8-15 at.% [Yb]

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	1 mm	Brewster-angle cut	12% Yb, 1,5% Er	Uncoated	7068
		Right-angle cut	12% Yb, 1,5% Er	AR/AR@976 nm + 1480-1600 nm	7065
	2 mm	Brewster-angle cut	12% Yb, 1,5% Er	Uncoated	7069
		Right-angle cut	12% Yb, 1,5% Er	AR/AR@976 nm + 1480-1600 nm	7066
	3 mm	Brewster-angle cut	12% Yb, 1,5% Er	Uncoated	7070
		Right-angle cut	12% Yb, 1,5% Er	AR/AR@976 nm + 1480-1600 nm	7067



Tm:YLF crystals

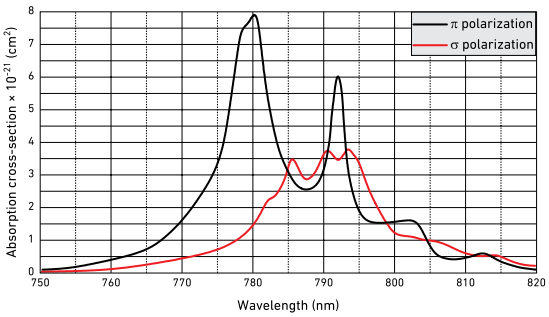
Main features

- Strong absorption bands for laser diode pumping
- Weak thermal lensing
- High polarization purity
- Custom crystals available upon request

Application examples

- LIDAR systems for remote sensing applications
- Pump source for Ho^{3+}:YAG lasersx

Tm^{3+}:YLF crystal features high absorption peaks conveniently located for diode pumping around 792 nm and exhibits a cross-relaxation process, which creates two ions in the upper laser level for each pump photon absorbed. Tm^{3+}:YLF lasers are ideal pump sources for Ho^{3+}:YAG lasers. This is due to a good overlap of Tm^{3+}:YLF emission and Ho^{3+}:YAG absorption spectra and capacity of producing linearly polarized output. What is more, the refractive index of Tm^{3+}:YLF decreases with temperature, leading to a negative thermal lens that is partly compensated by a positive lens effect due to end face bulging.



Standard specifications

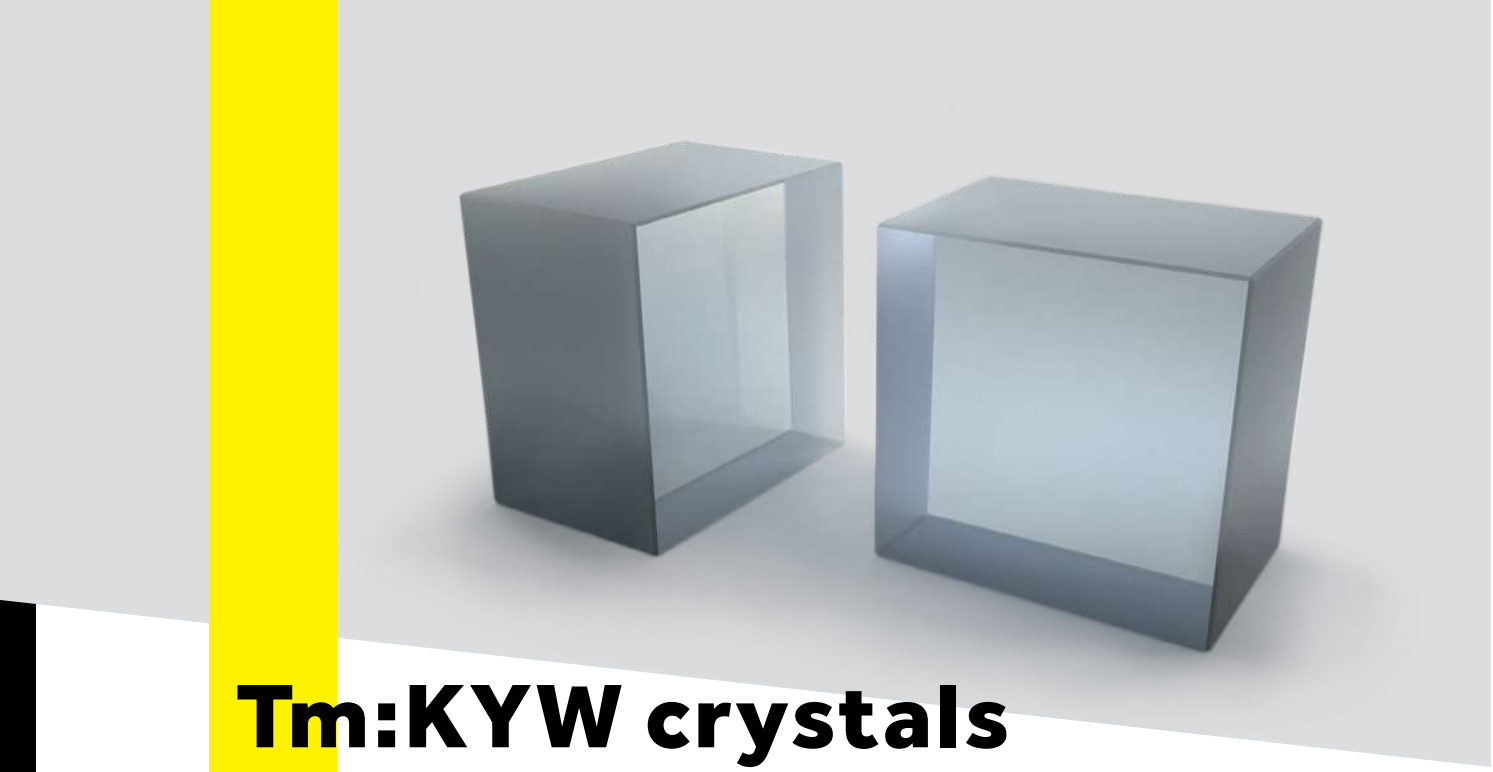
TM:YLF CRYSTALS	
Orientation	a-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@792 nm + AR(R< 0,35%) @1800-1960 nm on both faces
Laser induced damage threshold	>10 J/cm²@1900 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	792 nm
Absorption cross-section at peak	$0,55 \times 10^{-20}$ cm²
Absorption bandwidth at peak wavelength	16 nm
Laser wavelength	1900 nm
Lifetime of $^3F_4$ thulium energy level	16 ms
Emission cross-section @1900 nm	$0,4 \times 10^{-20}$ cm²
Refractive index @1064 nm	n_o = 1,448, n_e = 1,470
Crystal structure	tetragonal
Density	3,95 g/cm³
Mohs's hardness	5
Thermal conductivity	6 $Wm^{-1}K^{-1}$
dn/dT	$-4,6 \times 10^{-6}$ (IIc) K^{-1}, $-6,6 \times 10^{-6}$ (IIa) K^{-1}
Thermal expansion coefficient	$10,1 \times 10^{-6}$ (IIc) K^{-1}, $14,3 \times 10^{-6}$ (IIa) K^{-1}
Typical doping level	2-4 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	8 mm	Brewster-angle cut	3%	Uncoated	7817
		Right-angle cut	3%	AR/AR@792 nm + 1800-1960 nm	7816



Tm:KYW crystals

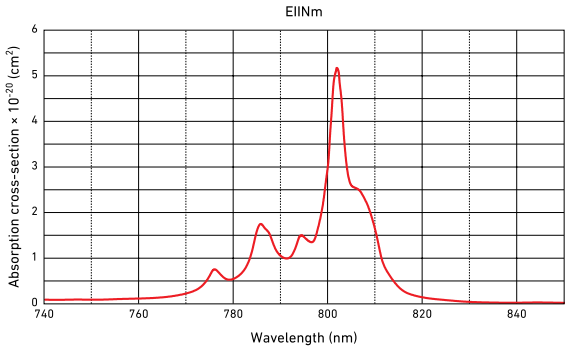
Main features

- Broad fluorescence band
- Large emission cross-section
- Relatively low upper-level lifetime
- Custom crystals available upon request

Application examples

- CW and Q-switched lasers emitting near 2 µm for application in surgery, range finding and environmental monitoring
- 2 µm wavelength region femtosecond lasers

Double tungstate crystals are optically biaxial and their optical properties have to be described within the frame of optical indicatrix axes (Np, Nm and Ng). Advantages of Tm-doped KYW crystals include a broad fluorescence band, a large emission cross section and a relatively low upper level lifetime. Such combination of properties is very promising for generation of femtosecond pulses in solid-state laser systems.



Standard specifications

TM:KYW CRYSTALS	
Orientation	N_g-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/10@632,8 nm
Coatings	AR(R<0,5%)@802 nm + AR(R< 0,35%) @1900-2000 nm on both faces
Laser induced damage threshold	>10 J/cm^2@1900 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES	
Absorption peak wavelength	802 nm
Absorption cross-section at peak	5,2 × 10^{-20} cm^2
Absorption bandwidth at peak wavelength	5,5 nm
Laser wavelength	1910 nm
Lifetime of $^3F_4$ energy level	1,1 ms
Emission cross-section @1910 nm	1,15 × 10^{-20} cm^2
Refractive index @1040nm	n_g = 2,05, n_m = 2,01, n_p = 1,97
Crystal structure	Monoclinic
Density	6,5 g/cm^3
Mohs hardness	4-5
Thermal conductivity	~3,3 Wm^{-1}K^{-1}
dn/dT	dn_m/dT = -9,2 × 10^{-6} K^{-1}
Thermal expansion coefficient	α_p=1,83 × 10^{-6}K^{-1}, α_m=10,29 × 10^{-6}K^{-1}, α_g=15,94 × 10^{-6} K^{-1}
Typical doping level	~5 at.%

Standard products

FACE DIMENSIONS	LENGTH	END FACES	DOPING	COATINGS	SKU
3 x 3 mm	2 mm	Brewster-angle cut	5%	Uncoated	7841
		Right-angle cut	5%	AR/AR@802 nm +1900-2000 nm	7840

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Cr:YAG crystals

V:YAG crystals

Co:Spinel crystals

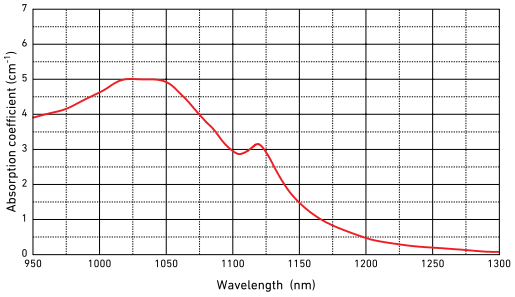
Cr:YAG crystals

Main features

- Good chemical stability and reliability
- Long lifetime and good thermal conductivity
- Easy to operate
- Custom crystals available upon request

Application examples

- Passively Q-switched lasers for laser rangefinders, LIDAR and LIBS systems
- Laser systems where short pulses are required



Standard specifications

CR:YAG CRYSTALS	
Initial transmission T_0	5-99 %@1064 nm
Initial transmission T_0 tolerance	±1% (for values larger than 80 %)
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	<λ/4@632,8
Coatings	AR(R<0,15%)@1064 nm on both sides
Laser induced damage threshold	>10 J/cm²@1064 nm, 10 ns
Mount	Unmounted

Cr^{4}+:YAG crystals are ideal for passive Q-switch operation of Nd:YAG and other Nd^{3}+ or Yb^{3}+ doped laser crystals in the wavelength range of 900 nm to 1200 nm. Remarkable feature of Cr^{4}+:YAG is the high damage threshold of >10 J/cm²@1064 nm, 10 ns. Its absorption band extends from 900 nm to 1200 nm and peaks around 1020 nm - 1070 nm with a very large absorption cross-section.

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES						
Material	σ_{gsa} [1]@1,064 µm	σ_{esa} [2]@1,064 µm	τ_{sa} [3]	Laser crystal	λ_{laser}	σ_{gsa}/σ_{em} [4]
$Cr^{4+}:Y_3Al_5O_{12}$	46×10^{-19} cm²	$8,2 \times 10^{-19}$ cm²	3,4 µs	Nd:YAG	0,946 µm	130
				Nd:YAG	1,06 µm	17
				Nd:GSAG	1,06 µm	55
				Nd:YVO_4	1,06 µm	3,5
				Nd:$GdVO_4$	1,06 µm	5
				Nd:$LuVO_4$	1,06 µm	3,4
				Nd:LSB	1,06 µm	40
				Nd:YAP	1,08 µm	14
				Yb:NLM	1,01 µm	500
				Yb:YVO_4	1,02 µm	625
				Yb:GGG	1,025 µm	250
				Yb:YAG	1,03 µm	250
				Yb:LuAG	1,03 µm	185
				Yb:KGW	1,035 µm	185

Crystal structure	Cubic
Density	4,56 g/cm³
Thermal expansion coefficient	$6,14 \times 10^{-6}$ K⁻¹
Thermal conductivity	11,2 Wm⁻¹K⁻¹
Mohs hardness	8,2
Refractive index	1,82@1064 nm

Herewith:
σ_{gsa} [1]) – ground-state absorption cross-section
σ_{esa} [2]) – excited-state absorption cross-section
τ_{sa} [3]) – recovery time
σ_{em} [4]) – emission cross-section

Standard products

FACE DIMENSIONS	INITIAL TRANSMISSION	COATINGS	SKU
ø3 mm	20%@1064 nm	AR/AR@1064 nm	7279
	30%@1064 nm	AR/AR@1064 nm	7280
	40%@1064 nm	AR/AR@1064 nm	7281
	50%@1064 nm	AR/AR@1064 nm	7282
	60%@1064 nm	AR/AR@1064 nm	7283
	70%@1064 nm	AR/AR@1064 nm	7284
	80%@1064 nm	AR/AR@1064 nm	7285
	85%@1064 nm	AR/AR@1064 nm	7286
	90%@1064 nm	AR/AR@1064 nm	7287
	95%@1064 nm	AR/AR@1064 nm	7288
	98%@1064 nm	AR/AR@1064 nm	7289
ø6 mm	20%@1064 nm	AR/AR@1064 nm	7301
	30%@1064 nm	AR/AR@1064 nm	7302
	40%@1064 nm	AR/AR@1064 nm	7303
	50%@1064 nm	AR/AR@1064 nm	7304
	60%@1064 nm	AR/AR@1064 nm	7305
	70%@1064 nm	AR/AR@1064 nm	7306
	80%@1064 nm	AR/AR@1064 nm	7307
	85%@1064 nm	AR/AR@1064 nm	7308
	90%@1064 nm	AR/AR@1064 nm	7309
	95%@1064 nm	AR/AR@1064 nm	7310
	98%@1064 nm	AR/AR@1064 nm	7311
3 x 3 mm	20%@1064 nm	AR/AR@1064 nm	7290
	30%@1064 nm	AR/AR@1064 nm	7291
	40%@1064 nm	AR/AR@1064 nm	7292
	50%@1064 nm	AR/AR@1064 nm	7293
	60%@1064 nm	AR/AR@1064 nm	7294
	70%@1064 nm	AR/AR@1064 nm	7295
	80%@1064 nm	AR/AR@1064 nm	7296
	85%@1064 nm	AR/AR@1064 nm	7297
	90%@1064 nm	AR/AR@1064 nm	7298
	95%@1064 nm	AR/AR@1064 nm	7299
	98%@1064 nm	AR/AR@1064 nm	7300

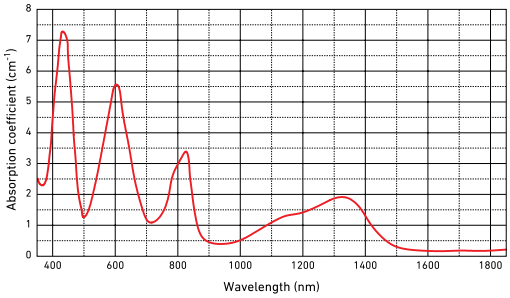
V:YAG

Main features

- High ground state absorption
- Insignificant excited state absorption
- High contrast of the Q-switch
- Good optical, mechanical, and thermal properties
- UV-resistant and features a high damage threshold
- Custom crystals available upon request

Application examples

- Passively Q-switched lasers for laser rangefinders, LIDAR and LIBS systems



Standard specifications

V:YAG CRYSTALS	
Initial transmission T_0	30-98%@1340 nm
Initial transmission T_0 tolerance	±1% (for values larger than 80%)
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	<λ/4@632,8
Coatings	AR(R<0,2%)@1310-1360 nm on both sides
Laser induced damage threshold	>10 J/cm^2@1340 nm, 10 ns
Mount	Unmounted

V:YAG is a relatively new saturable absorber. Passive Q-switch operation is available in the spectral range from 1064 nm to 1440 nm, primarily because of an extremely high ground state. These crystals can be used with active laser media such as Nd:YAG, Nd:YAP, Nd:KGW, Nd:YVO_4 and provide good lasing characteristics in passive Q-switched lasers. V:YAG features excellent optical, mechanical, and thermal properties and can be grown by Czochralski method.

Properties

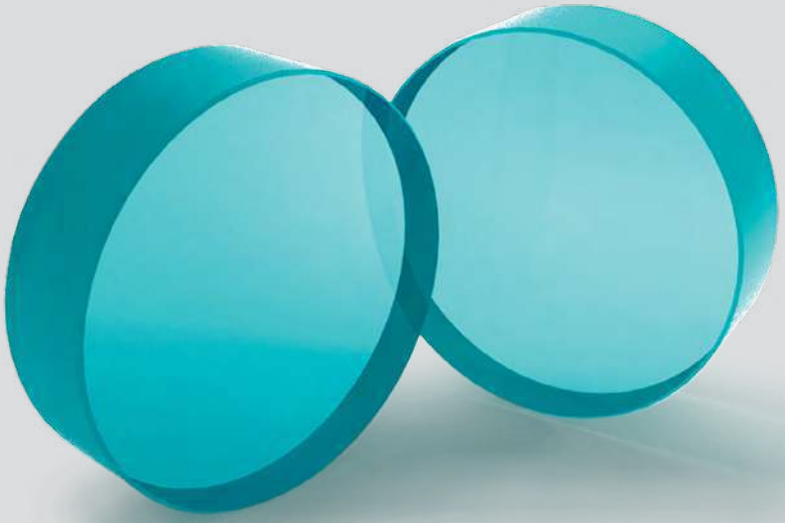
SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES						
Material	σ_{gsa} [1]@1,34 µm	σ_{esa} [2]@1,34 µm	τ_{sa} [3]	Laser crystal	λ_{laser}	σ_{gsa}/σ_{em} [4]
$V^{3+}:Y_3Al_5O_{12}$	72 × 10^{-19} cm^2	7,4 × 10^{-19} cm^2	5-37 ns	Pr:YAP	0,747 µm	10
				Ti:Al_2O_3	0,78 µm	25
				Cr:LiCAF	0,78 µm	80
				Nd:GGG	0,93 µm	-
				Nd:YLF	1,05 µm	15
				Nd:YAG	1,06 µm	8
				Nd:YVO_4	1,06 µm	1,5
				Yb:KYW	1,035 µm	70
				Nd:YAP	1,34 µm	24
				Nd:$GdVO_4$	1,34 µm	30
				Er:glass	1,54 µm	45

Crystal structure	Cubic
Density	4,56 g/cm^3
Thermal expansion coefficient	6,14 × 10^{-6} K^{-1}
Thermal conductivity	11,2 Wm^{-1}K^{-1}
Mohs hardness	8,2
Refractive index	1,82@1064 nm

Herewith:
σ_{gsa} [1]) – ground-state absorption cross-section
σ_{esa} [2]) – excited-state absorption cross-section
τ_{sa} [3]) – recovery time
σ_{em} [4]) – emission cross-section

Standard products

FACE DIMENSIONS	INITIAL TRANSMISSION	COATINGS	SKU
ø5 mm	30%@1340 nm	AR/AR@1310-1360 nm	7321
	40%@1340 nm	AR/AR@1310-1360 nm	7322
	50%@1340 nm	AR/AR@1310-1360 nm	7323
	60%@1340 nm	AR/AR@1310-1360 nm	7324
	70%@1340 nm	AR/AR@1310-1360 nm	7325
	80%@1340 nm	AR/AR@1310-1360 nm	7326
	85%@1340 nm	AR/AR@1310-1360 nm	7327
	90%@1340 nm	AR/AR@1310-1360 nm	7328
	95%@1340 nm	AR/AR@1310-1360 nm	7329
3 x 3 mm	30%@1340 nm	AR/AR@1310-1360 nm	7312
	40%@1340 nm	AR/AR@1310-1360 nm	7313
	50%@1340 nm	AR/AR@1310-1360 nm	7314
	60%@1340 nm	AR/AR@1310-1360 nm	7315
	70%@1340 nm	AR/AR@1310-1360 nm	7316
	80%@1340 nm	AR/AR@1310-1360 nm	7317
	85%@1340 nm	AR/AR@1310-1360 nm	7318
	90%@1340 nm	AR/AR@1310-1360 nm	7319
	95%@1340 nm	AR/AR@1310-1360 nm	7320



Co:Spinel crystals

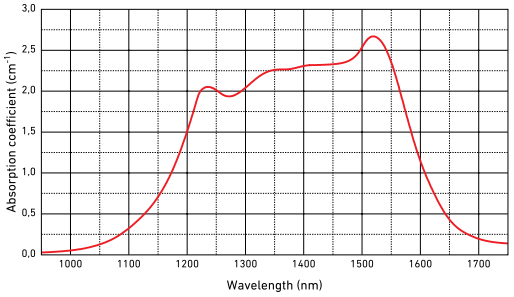
Main features

- Low optical losses in the wavelength range of 1,3 µm - 1,6 µm
- High laser induced damage threshold
- Custom crystals available upon request

Application examples

- Passive Q-switch for Er:Glass lasers @1,54 µm

Co:Spinel is a recently developed material, which has been proven to be a very effective passive Q-switch in lasers emitting in the range of 1,2 µm - 1,6 µm. Co:Spinel has a high absorption cross-section, which permits Q-switch operation of Er:glass laser (both flash-lamp and diode-laser pumped) without an intracavity focusing. Negligible excited-state absorption results in a high contrast Q-switch operation, the ratio of initial (small signal) to saturated absorption is higher than 10.



Standard specifications

CO:SPINEL CRYSTALS	
Available initial T_0 transmission	50-99 %@1535 nm
Initial transmission T_0 tolerance	±1% (for values larger than 80%)
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	<λ/4@632,8 nm
Coatings	AR(R<0,15%)@1535 nm
Laser induced damage threshold	>8 J/cm²@1535 nm, 10 ns
Mount	Unmounted

Properties

SPECTROSCOPIC AND THERMO-MECHANICAL PROPERTIES						
Material	σ_{gsa} [1]@1,54 µm	σ_{esa} [2]@1,54 µm	τ_{sa} [3]	Laser crystal	λ_{laser}	σ_{gsa}/σ_{em} [4]
$Co^{2+}:MgAl_2O_4$	$3,5 \times 10^{-19}$ cm²	$0,1 \times 10^{-19}$ cm²	220-350 ns	Nd:YAP	1,34 µm	1,5
				Nd:KGW	1,35 µm	4
				Nd:YAG	1,44 µm	12
				Er:glass	1,54 µm	40

Crystal structure	Cubic
Density	3,58 g/cm³
Thermal expansion coefficient	$6,14 \times 10^{-6}$ K⁻¹
Thermal conductivity	17 Wm⁻¹K⁻¹
Mohs hardness	8
Refractive index	1,6-1,75

Herewith:
σ_{gsa} [1]) – ground-state absorption cross-section
σ_{esa} [2]) – excited-state absorption cross-section
τ_{sa} [3]) – recovery time
σ_{em} [4]) – emission cross-section

Standard products

FACE DIMENSIONS	INITIAL TRANSMISSION	COATINGS	SKU
3 x 3 mm	80%@1535 nm	AR/AR@1535 nm	7331
	85%@1535 nm	AR/AR@1535 nm	7332
	90%@1535 nm	AR/AR@1535 nm	7333
	92%@1535 nm	AR/AR@1535 nm	7334
	95%@1535 nm	AR/AR@1535 nm	7335
	97%@1535 nm	AR/AR@1535 nm	7336
5 x 5 mm	80%@1535 nm	AR/AR@1535 nm	7338
	85%@1535 nm	AR/AR@1535 nm	7339
	90%@1535 nm	AR/AR@1535 nm	7340
	92%@1535 nm	AR/AR@1535 nm	7341
	95%@1535 nm	AR/AR@1535 nm	7342
	97%@1535 nm	AR/AR@1535 nm	7343

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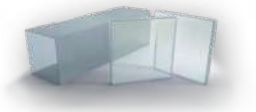
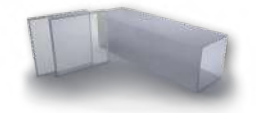


BBO crystals



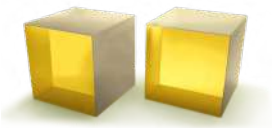
LBO crystals

KTP crystals

KDP, DKDP crystals

Lithium niobate crystals

$AgGaSe_2$ crystals

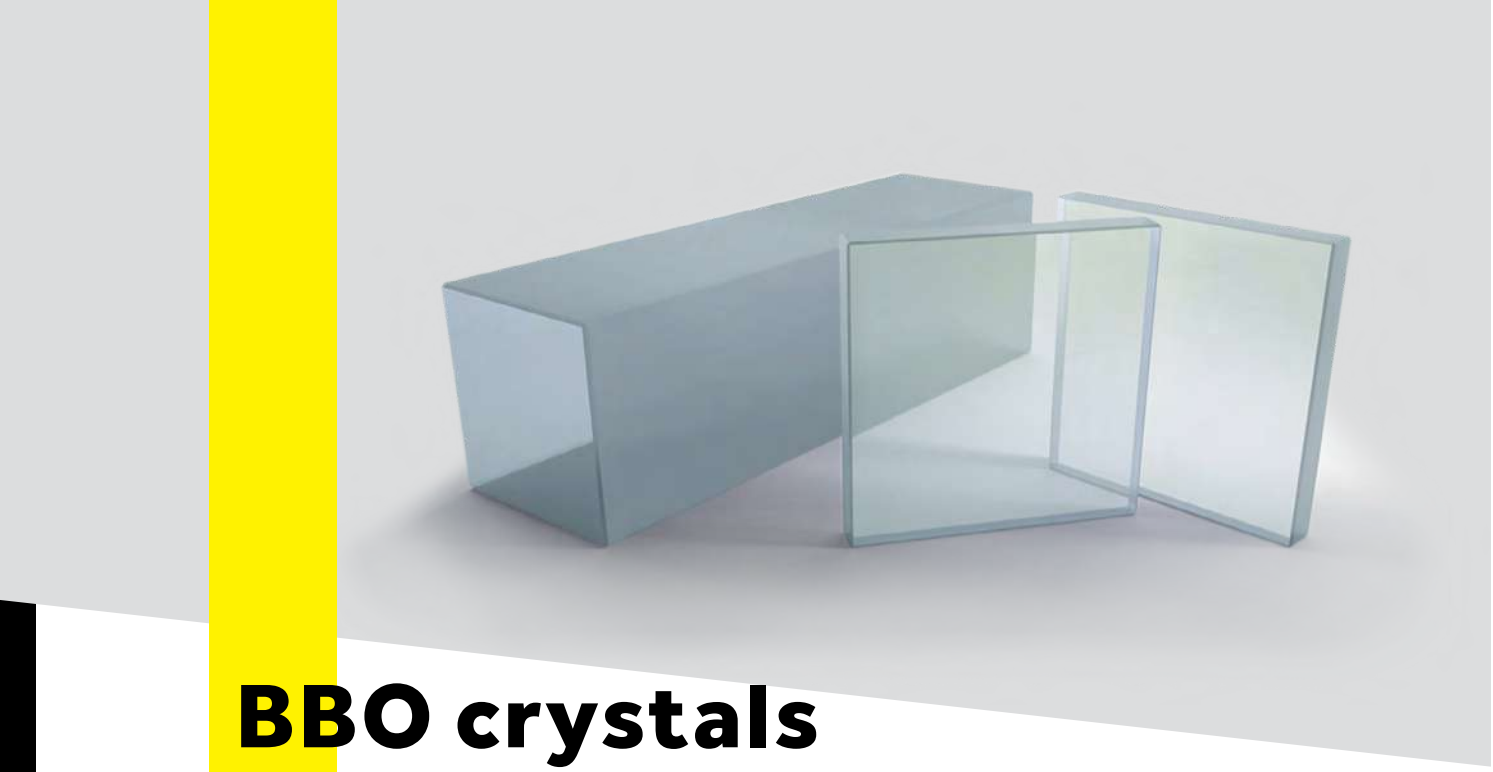


$AgGaS_2$ crystals

$ZnGeP_2$ crystals

CdSe crystals

GaSe crystals



BBO crystals

Main features

- Broad transparency range from 188 nm to 5,2 µm (reasonable transparency @3 µm - 5,2 µm for few tens µm thick crystals)
- Broad phase-matchable range for various second order nonlinear interactions over almost the entire transparency range
- Wide thermal acceptance bandwidth
- Highest nonlinearity of all UV nonlinear crystals
- High laser induced damage threshold
- Ultrathin crystals available for few optical cycle laser pulses
- Custom size, orientation and coatings are available upon request

Application examples

- Harmonic generation (up to fifth) of pulsed Nd-doped crystal based lasers
- Frequency doubling, tripling of pulsed Ti:Sapphire, Yb-doped, dye lasers
- Widely tunable type I and II OPO
- Characterization of ultrashort laser pulses by FROG, XFROG, SPIDER, dispersion scan, chirp scan methods

BBO crystal transparency ranges from 188 nm to 5,2 µm, which includes reasonable transparency from 3 µm - 5,2 µm for few tens µm thick crystals, while their phase-matchable range spans almost over the entire transparency range. Combined with other magnificent properties of BBO, it is favorable for numerous nonlinear parametric applications, e.g. harmonic generation of pulsed Yb-doped crystal based lasers and frequency doubling, tripling of Ti:Sapphire lasers, widely tunable type I and II OPO. It is worth to mention that BBO crystals have the highest nonlinearity in the UV range out of all common nonlinear crystals.

Standard specifications

BBO CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<5 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Wavefront distortion	<λ/8@632,8 nm
Coatings	Low dispersion protective coatings or antireflective coatings on both sides
Laser induced damage threshold	>500 MW/cm^2@1064 nm, 10 ns
UVFS support	Crystals with <0,1 mm thickness are optically contacted to 0,5-1 mm UVFS support
Mount	Mounted in ø25,4 mm black or natural aluminum mount

Properties

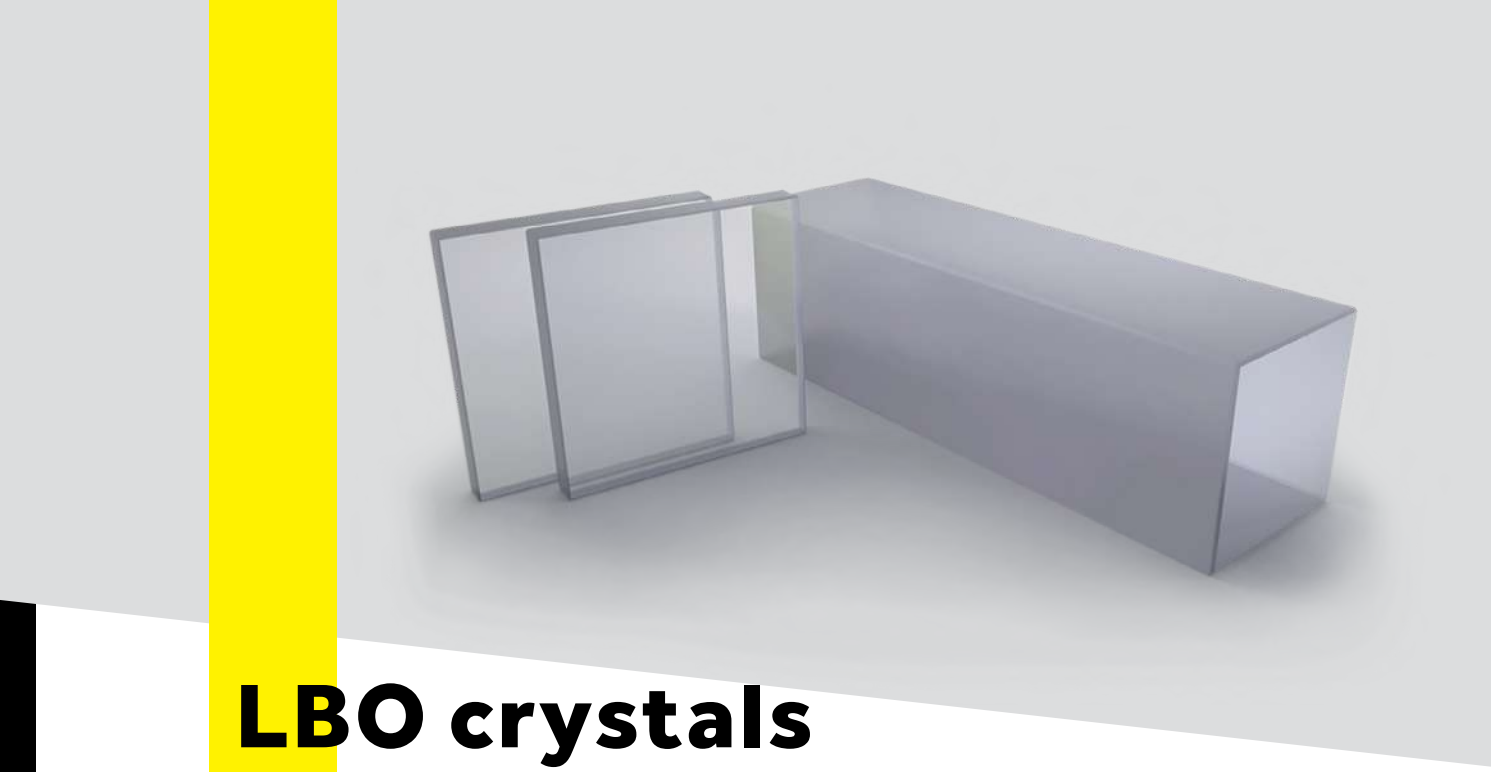
PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	β-BaB_2O_4
Crystal structure	Rhombohedral, 3m
Lattice parameters	a=12,532 Å, c=12,717 Å
Optical symmetry	Negative uniaxial (n_o>n_e)
Density	3,85 g/cm^3
Mohs hardness	4-4,5
Transparency range	188 nm – 5,2 µm, reasonable from 3 µm to 5,2 µm for thin crystals (few tens of µm)
Sellmeier equations @188 nm - 5,2 µm range (λ in µm)	$n_o^2 = 1 + 0{,}90291\ \lambda^2/(\lambda^2 - 0{,}003926) + 0{,}83155\ \lambda^2/(\lambda^2 - 0{,}018786) + 0{,}76536\ \lambda^2/(\lambda^2 - 60{,}01)$; $n_e^2 = 1 + 1{,}151075\ \lambda^2/(\lambda^2 - 0{,}007142) + 0{,}21803\ \lambda^2/(\lambda^2 - 0{,}02259) + 0{,}656\ \lambda^2/(\lambda^2 - 263)$
Refractive indices	n_o = 1,6551, n_e = 1,5426 @1064 nm

Guidance

Optogama provide guidance and theoretical calculations for particular BBO applications. Contact us and we will help you to configure your crystal.

Standard products

FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
6 x 6 mm	0,1 mm	50°	90°	P/P@515/257 nm	SHG@515 nm, 50 fs, type I	15808
	0,15 mm	50°	90°	P/P@515/257 nm	SHG@515 nm, 100 fs, type I	15809
	0,3 mm	50°	90°	P/P@515/257 nm	SHG@515 nm, 200 fs, type I	15810
	0,05 mm	29,2°	90°	P/P@400-800 nm	SHG@800 nm, 10 fs, type I	15811
	0,1 mm	29,2°	90°	P/P@400-800 nm	SHG@800 nm, 20 fs, type I	6399
	0,2 mm	29,2°	90°	P/P@400-800 nm	SHG@800 nm, 50 fs, type I	15833
	0,5 mm	29,2°	90°	P/P@400-800 nm	SHG@800 nm, 100 fs, type I	6398
	1 mm	29,2°	90°	P/P@400-800 nm	SHG@800 nm, 200 fs, type I	6400
	0,5 mm	23,4°	90°	AR/AR@515+1030 nm	SHG@1030 nm, 50 fs, type I	9447
	1 mm	23,4°	90°	AR/AR@515+1030 nm	SHG@1030 nm, 100 fs, type I	9448
	1,5 mm	23,4°	90°	AR/AR@515+1030 nm	SHG@1030 nm, 150 fs, type I	9449
	2 mm	23,4°	90°	AR/AR@515+1030 nm	SHG@1030 nm, 200 fs, type I	10733
	0,01 mm	44,3°	90°	P/P@400-800/266 nm	THG@800 nm, 10 fs, type I	15834
	0,02 mm	44,3°	90°	P/P@400-800/266 nm	THG@800 nm, 20 fs, type I	15835
	0,05 mm	44,3°	90°	P/P@400-800/266 nm	THG@800 nm, 50 fs, type I	15836
	0,1 mm	44,3°	90°	P/P@400-800/266 nm	THG@800 nm, 100 fs, type I	9044
	0,2 mm	44,3°	90°	P/P@400-800/266 nm	THG@800 nm, 200 fs, type I	15837
	0,15 mm	32,5°	90°	AR/AR@515+1030/343 nm	THG@1030 nm, 50 fs, type I	9450
	0,25 mm	32,5°	90°	AR/AR@515+1030/343 nm	THG@1030 nm, 100 fs, type I	9451
	0,55 mm	32,5°	90°	AR/AR@515+1030/343 nm	THG@1030 nm, 200 fs, type I	9452



LBO crystals

Main features

- Broad transparency range from 155 nm to 3200 nm
- Absence of photochromic damage (gray-tracking)
- Highest damage threshold among common nonlinear crystals
- Small walk-off angle at room temperature, no walk-off at NCPM regime
- Wide acceptance angle
- Temperature tunable type I and II non-critical phase-matching
- Custom size, orientation and coatings are available upon

Application examples

- Sum-frequency generation of 532 nm and 1064 nm to produce 355 nm UV radiation
- Widely tunable OPOs in NIR range pumped by second harmonic of Nd-doped lasers
- Efficient second harmonic generation at 1064 nm without walk-off effect (NCPM, t = 149 °C)

Lithium Triborate (LiB3O5, LBO) crystals feature a broad transparency range, wide acceptance angle, small walk-off angle and the highest damage threshold among common nonlinear crystals. Most common applications include high-power near-infrared wavelength second harmonic generation, sum frequency generation to produce visible, ultraviolet laser light and visible, near-infrared widely tuned optical parametric oscillators.

Standard specifications

LBO CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Wavefront distortion	<λ/4@632,8 nm
Coatings	AR coatings on both sides
Laser induced damage threshold	>1 GW/cm²@1064 nm, 10 ns
Mount	Unmounted

Properties

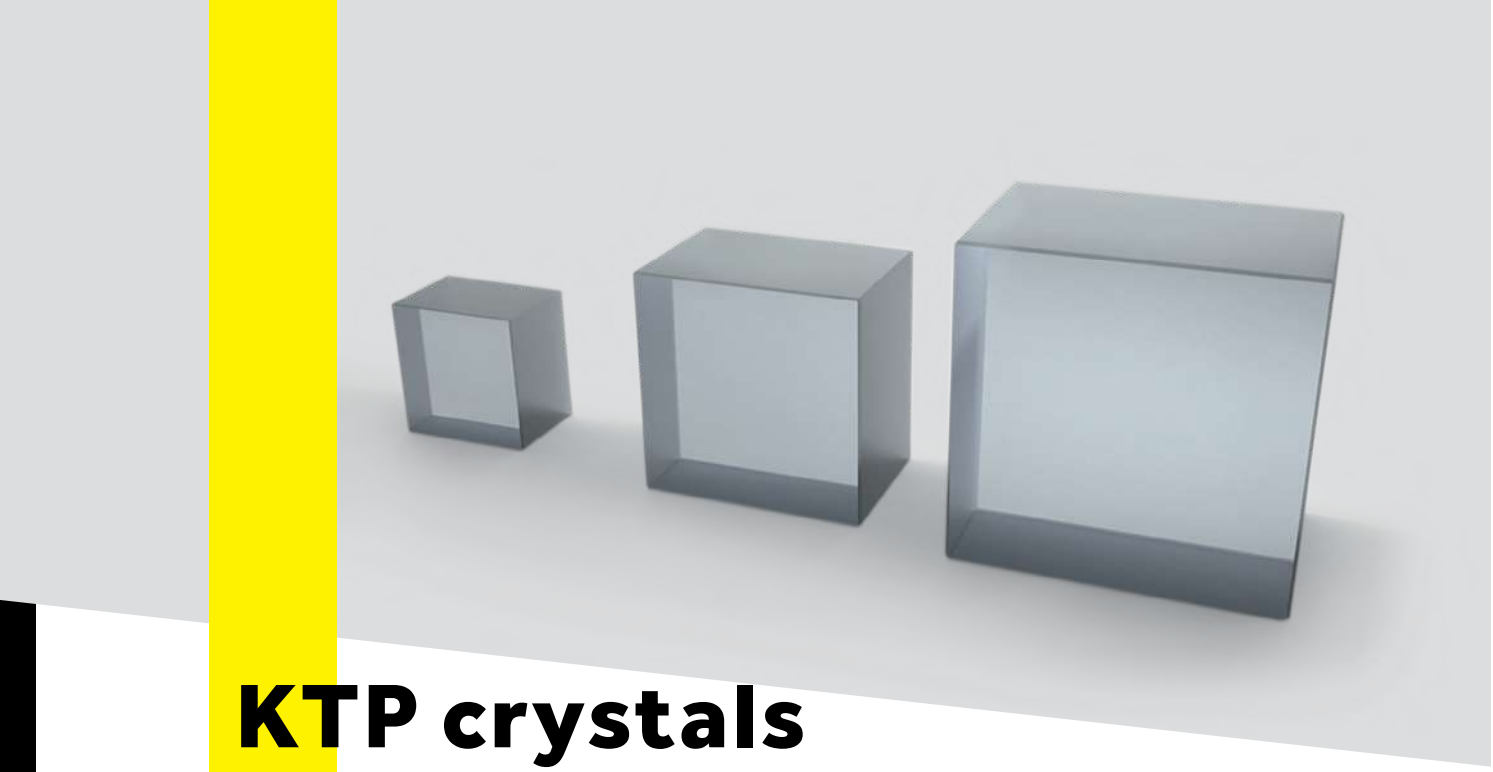
PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	LiB_3O_5
Crystal structure	Orthorhombic, mm^2
Lattice parameters	a = 8,46 Å, b = 7,38 Å , c = 12,717 Å
Optical symmetry	Negative biaxial ($2V_z$ = 109,2° @0,5321 µm)
Density	2,474 g/cm³
Mohs hardness	6-7
Transparency range	155 nm - 3,2 µm @"0" transmittance level
Sellmeier equations @T = 293 K (λ in µm)	$n_x^2 = 2{,}4542 + 0{,}01125/(\lambda^2 - 0{,}01135) - 0{,}01388\,\lambda^2$; $n_y^2 = 2{,}5390 + 0{,}01277/(\lambda^2 - 0{,}01189) - 0{,}01849\,\lambda^2 + 4{,}3025\times10^{-5}\lambda^4 - 2{,}9131\times10^{-5}\lambda^6$; $n_z^2 = 2{,}5865 + 0{,}0131/(\lambda^2 - 0{,}01223) - 0{,}01862\,\lambda^2 + 4{,}5778\times10^{-5}\lambda^4 - 3{,}2526\times10^{-5}\lambda^6$
Refractive indices	$n_x = 1{,}5656$; $n_y = 1{,}5905$; $n_z = 1{,}6055$ @1064 nm

Guidance

Optogama provides guidance and theoretical calculations for particular LBO applications. Contact us and we will help you to configure your crystal.

Standard products

FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
3 x 3 mm	10 mm	90°	11,6°	AR/AR@532+1064 nm	SHG@1064 nm, type I	7203
	10 mm	42,2°	90°	AR/AR@532+1064/355 nm	THG@1064 nm, type II	7199
	10 mm	90°	0°	AR/AR@532+1064 nm	NCPM SHG@1064 nm, T = 149 °C	7209
	20 mm	90°	11,6°	AR/AR@532+1064 nm	SHG@1064 nm, type I	7202
	20 mm	42,2°	90°	AR/AR@532+1064/355 nm	THG@1064 nm, type II	9457
	20 mm	90°	0°	AR/AR@532+1064 nm	NCPM SHG@1064 nm, T = 149 °C	7210
5 x 5 mm	10 mm	90°	11,6°	AR/AR@532+1064 nm	SHG@1064 nm, type I	7207
	10 mm	42,2°	90°	AR/AR@532+1064/355 nm	THG@1064 nm, type II	7204
	20 mm	90°	11,6°	AR/AR@532+1064 nm	SHG@1064 nm, type I	7208
	20 mm	42,2°	90°	AR/AR@532+1064/355 nm	THG@1064 nm, type II	9459
6 x 6 mm	1 mm	90°	13,8°	AR/AR@515+1030 nm	SHG@1030 nm, type I	9458
	2 mm	90°	13,8°	AR/AR@515+1030 nm	SHG@1030 nm, type I	9460
	3 mm	90°	13,8°	AR/AR@515+1030 nm	SHG@1030 nm, type I	9461
	4 mm	90°	13,8°	AR/AR@515+1030 nm	SHG@1030 nm, type I	9462



KTP crystals

Main features

- High nonlinearity
- Nonhygroscopic crystal
- Great mechanical stability
- Wide transparency range from 350 nm to 4,5 µm
- Broad angular and thermal acceptance
- Broad type I and II non-critical phase-matching range

Application examples

- Low and medium power frequency doubling of Nd-doped lasers
- KTP OPO and ZGP OPO tandem for mid-infrared generation

Potassium titanyl phosphate ($KTiOPO_4$, KTP) crystals are advantageous due to their high nonlinearity, great mechanical stability, high optical quality and transparency range of 350 nm - 4,5 µm. These features determine the wide application of KTP crystals as a nonlinear medium.
It is an excellent solution for frequency doubling applications of Nd-doped lasers, especially for low and medium power applications, both intra- and extra-cavity design.
Besides, these crystals can be used as a nonlinear OPO medium for IR generation up to 4 µm and used as a pump source for mid-IR nonlinear crystal based optical parametric oscillators, such as ZGP OPO. KTP is susceptible to photochromic damage (grey-tracking), which causes deterioration of nonlinear conversion efficiency. Optogama provide high grey track resistance (HGTR) KTP crystals as a solution, which significantly improves the grey-track resistance and overall performance. HGTR KTP crystals extend the use of KTP as a nonlinear medium to high-power applications.
Please request in case you need HGTR KTP crystals for your applications.

Standard specifications

KTP CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<5 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Wavefront distortion	<λ/8@632,8 nm
Coatings	AR(R<0,25%)532+1064 nm on both faces
Laser induced damage threshold	>500 MW/cm²@1064 nm, 10 ns
Mount	Unmounted

Properties

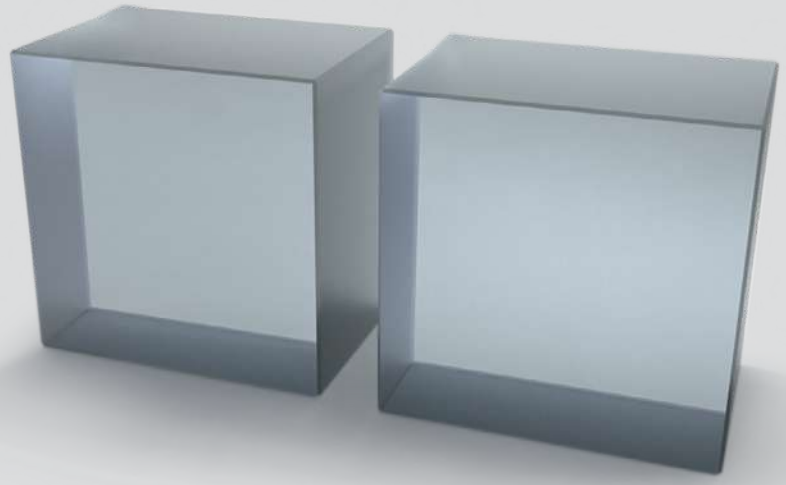
PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$KTiOPO_4$
Crystal structure	Orthorhombic, mm^2
Lattice parameters	a = 12,814 Å, b = 6,404 Å, c = 10,616 Å
Optical symmetry	Positive biaxial ($2V_z$ = 37,4° @0,5461 µm)
Density	2,945 g/cm³
Mohs hardness	5
Transparency range	350 nm - 4,5 µm @"0" transmittance level
Sellmeier equations (λ in µm)	$n_x^2 = 3{,}0067 + 0{,}0395/(\lambda^2 - 0{,}04251) - 0{,}01247\,\lambda^2$; $n_y^2 = 3{,}0319 + 0{,}04152/(\lambda^2 - 0{,}04586) - 0{,}01337\,\lambda^2$; $n_z^2 = 3{,}3134 + 0{,}05694/(\lambda^2 - 0{,}05941) - 0{,}016713\,\lambda^2$
Refractive indices	n_x = 1,7404; n_y = 1,7479; n_z = 1,8296 @1064 nm

Guidance

Optogama provide guidance and theoretical calculations for particular KTP applications. Contact us and we will help you to configure your crystal.

Standard products

FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
3 x 3 mm	5 mm	90°	23,5°	AR/AR@532+1064 nm	SHG@1064 nm, type II	7184
	10 mm	90°	23,5°	AR/AR@532+1064 nm	SHG@1064 nm, type II	7188
5 x 5 mm	5 mm	90°	23,5°	AR/AR@532+1064 nm	SHG@1064 nm, type II	7189
	10 mm	90°	23,5°	AR/AR@532+1064 nm	SHG@1064 nm, type II	7193
7 x 7 mm	5 mm	90°	23,5°	AR/AR@532+1064 nm	SHG@1064 nm, type II	7194
	10 mm	90°	23,5°	AR/AR@532+1064 nm	SHG@1064 nm, type II	7198



KDP, DKDP crystals

Main features

- Excellent ultraviolet radiation transmission
- High laser induced damage threshold
- Custom crystals available upon request

Application examples

- Frequency doublers, triplers and quadruplers for Nd-doped lasers
- Q-switches for Ti:Sapphire, Alexandrite, Nd-doped lasers

Potassium dihydrogen phosphate (KH_2PO_4, KDP) and potassium dideuterium phosphate (KD_2PO_4, DKDP) crystals are one of the oldest used nonlinear materials. DKDP and KDP are known as analogs, though their properties differ due to DKDP deuteration. They both exhibit excellent ultraviolet transmission and high damage threshold. The nonlinearity of these crystals is relatively low, but these crystals can be grown in large size. They found their application as nonlinear frequency doublers, triplers and quandruplers of Nd-doped lasers and as Q-switch devices for Ti:Sapphire, Alexandrite, Nd-doped lasers. Main drawback is that these crystals are highly hygroscopic, therefore sealed housing and dry operating conditions must be ensured.

Standard specifications

KDP, DKDP CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<5 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	20-10 S-D
Surface flatness	<λ/4@632,8 nm
Coatings	AR coatings on both sides
Laser induced damage threshold	>10 J/cm²@1064 nm, 10 ns for KDP crystals >5 J/cm²@1064 nm, 10 ns for DKDP
Mount	Unmounted

Properties

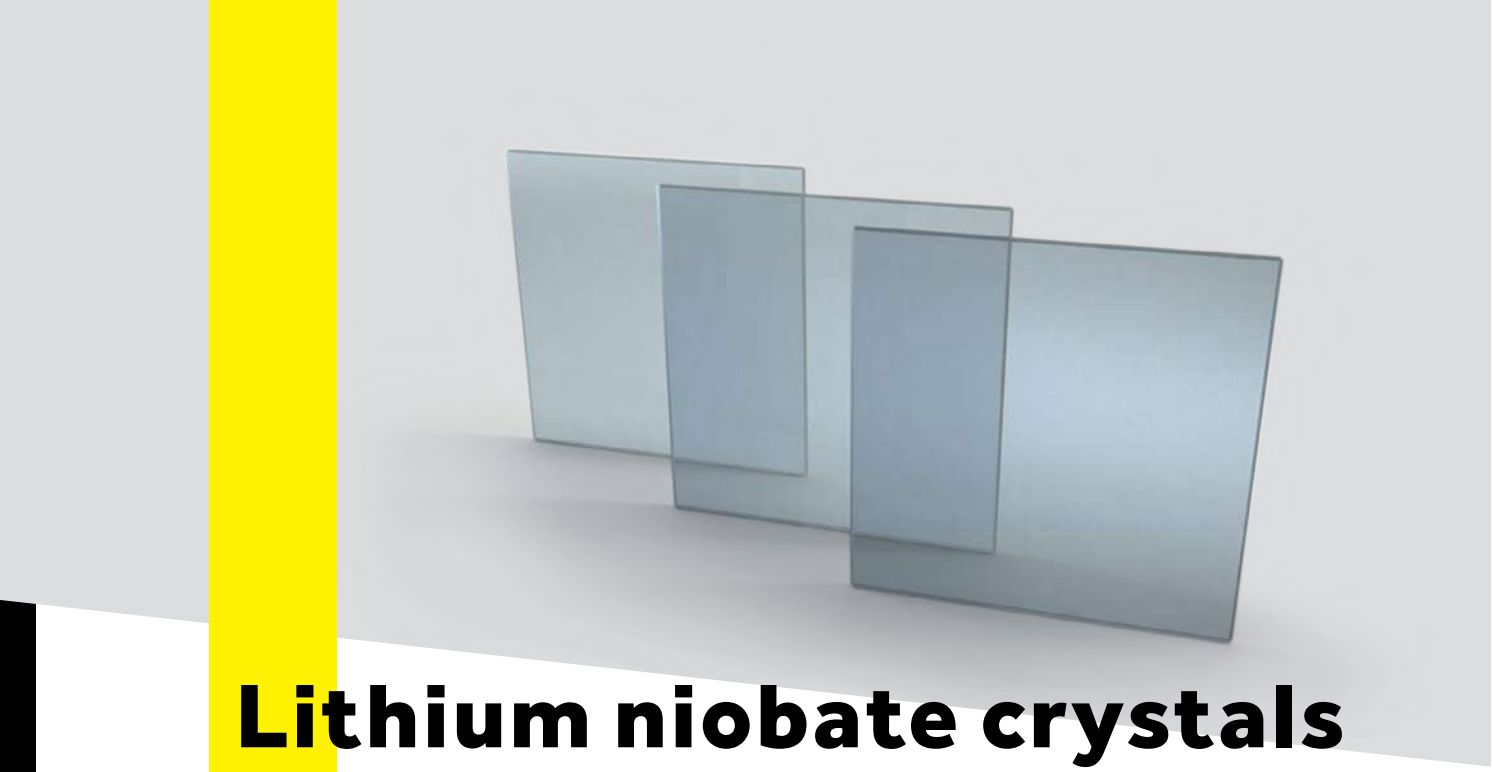
PHYSICAL AND OPTICAL PROPERTIES		
Chemical formula	KH_2PO_4 (KDP)	KD_2PO_4 (DKDP)
Crystal structure	Tetragonal, 42m	Tetragonal, 42m
Lattice parameters	a = 7,448 Å, c = 6,977 Å	a = 7,4697 Å, c = 6,966 Å
Optical symmetry	Negative uniaxial ($n_o > n_e$)	Negative uniaxial ($n_o > n_e$)
Density	2,332 g/cm³	2,355 g/cm³
Mohs hardness	2,5	2,5
Transparency range	180 nm - 1,5 µm	200 nm - 2 µm
Refractive indices	n_o = 1,4938, n_e = 1,4599 @1,06 µm	n_o = 1,4931; n_e = 1,4582 @1,06 µm
KDP Sellmeier equations @T = 293 k (λ in µm)	$n_o^2 = 2{,}259276 + 13{,}00522\,\lambda^2/(\lambda^2 - 400) + 0{,}01008956/(\lambda^2 - (77{,}26408)^{-1})$; $n_e^2 = 2{,}132668 + 3{,}2279924\,\lambda^2/(\lambda^2 - 400) + 0{,}008637494/(\lambda^2 - (81{,}42631)^2)$	
DKDP Sellmeier equations @T = 293 K (λ in µm)	$n_o^2 = 2{,}240921 + 2{,}246956\,\lambda^2/(\lambda^2 - (11{,}26591)^2) + 0{,}009676/(\lambda^2 - (0{,}124981)^2)$; $n_e^2 = 2{,}126019 + 0{,}784404\,\lambda^2/(\lambda^2 - (11{,}10871)^2) + 0{,}008578/(\lambda^2 - (0{,}109505)^2)$	

Guidance

Optogama provide guidance and theoretical calculations for particular KDP and DKDP applications. Contact us and we will help you to configure your crystal.

Standard products

MATERIAL	FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
KDP	12 x 12 mm	5 mm	76,5°	45°	AR/AR@532/266 nm	SHG@532 nm, type I	9421
	15 x 15 mm	7 mm	76,5°	45°	AR/AR@532/266 nm	SHG@532 nm, type I	9422
DKDP	12 x 12 mm	20 mm	53,5°	0°	AR/AR@1064/532+1064 nm	SHG@1064 nm, type II	9426
	12 x 12 mm	20 mm	59,3°	0°	AR/AR@1064/532+1064 nm	THG@1064 nm, type II	9425
	15 x 15 mm	13 mm	36,5°	45°	AR/AR@532+1064 nm	SHG@1064 nm, type I	9423
	15 x 15 mm	13 mm	53,5°	0°	AR/AR@532+1064 nm	SHG@1064 nm, type II	9424
	15 x 15 mm	20 mm	53,5°	0°	AR/AR@1064/532+1064 nm	SHG@1064 nm, type II	9427
	15 x 15 mm	20 mm	59,3°	0°	AR/AR@532+1064/355 nm	THG@1064 nm, type II	9428



Lithium niobate crystals

Main features

- Broad transparency region from 420 nm to 5200 nm
- High nonlinear, electro-optic and acousto-optic coefficients
- Nonhygroscopic, mechanically, and chemically stable

Application examples

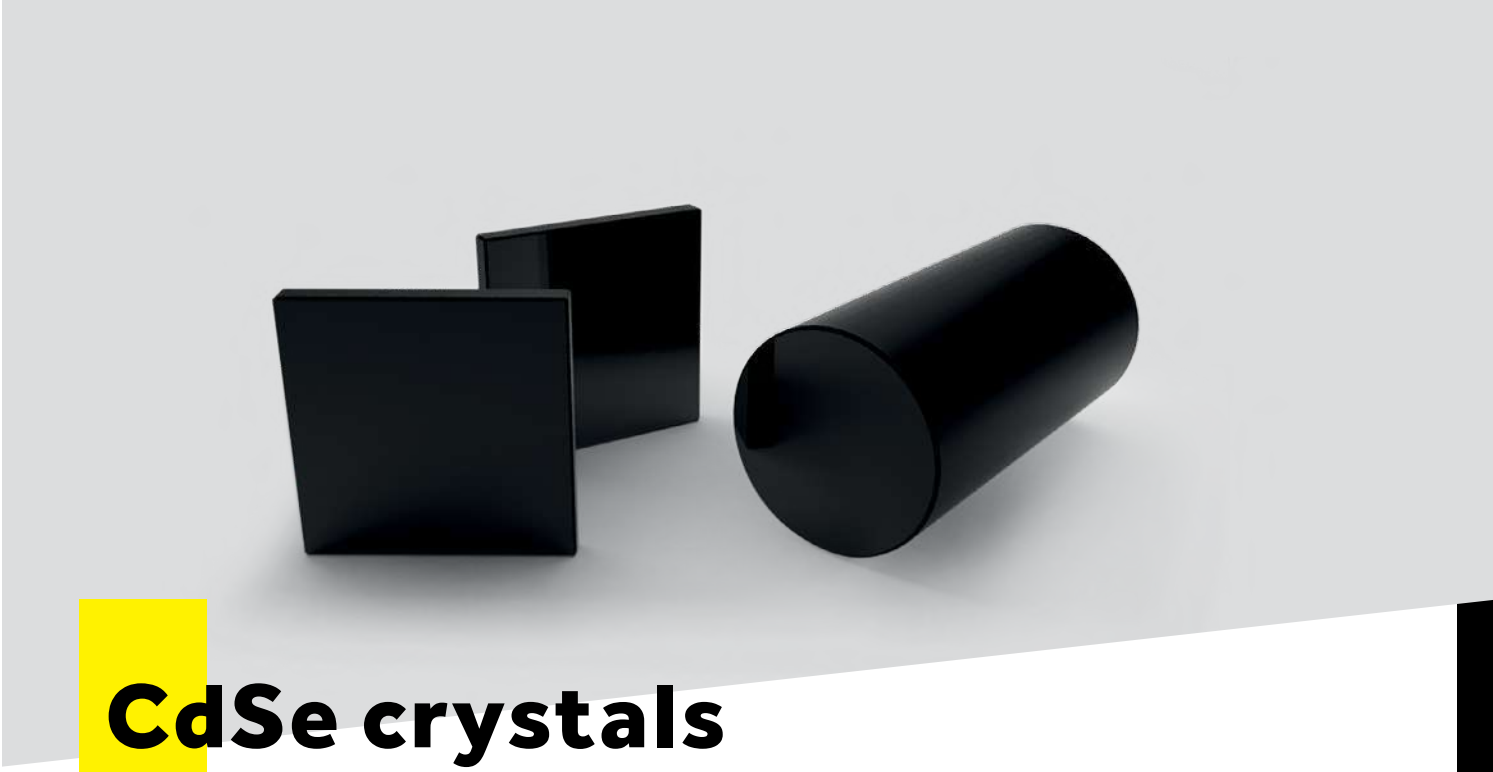
- Electro-optic modulation and Q-switching
- Optical parametric oscillators (OPO) pumped at 1064 nm
- Quasi-phase-matched devices with periodically poled lithium niobate (PPLN)

Optogama does not provide standard product list. Please contact us for solutions and pricing.

Lithium niobate ($LiNbO_3$, LN) is a multi-purpose material in photonics and optoelectronics fields. It features a wide transparency range from 420 nm to 5,2 μm, excellent nonlinear, electro-optic, and piezoelectric properties. Most common applications include infrared range optical modulation and Q-switching, nonlinear frequency conversion of >1 μm wavelengths. Their electrical and optical properties can be adjusted using magnesium or zirconium dopants.

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$LiNbO_3$
Crystal structure	Trigonal, 3m
Optical symmetry	Negative uniaxial ($n_o > n_e$)
Density	4,64 g/cm^3
Mohs hardness	5
Transparency range	420 nm - 5,2 μm
Sellmeier equations (λ in μm)	$n_o^2 = 4{,}9048 + 0{,}11768/(\lambda^2 - 0{,}04750) - 0{,}027169\,\lambda^2$; $n_e^2 = 4{,}5820 + 0{,}099169/(\lambda^2 - 0{,}04443) - 0{,}021950\,\lambda^2$
Refractive indices	$n_o = 2{,}220$; $n_e = 2{,}146$ @1064 nm



CdSe crystals

Main features

- Wide transparency range (0,7-24 μm)
- Reasonably large nonlinearity
- Small walk-off angle

Application examples

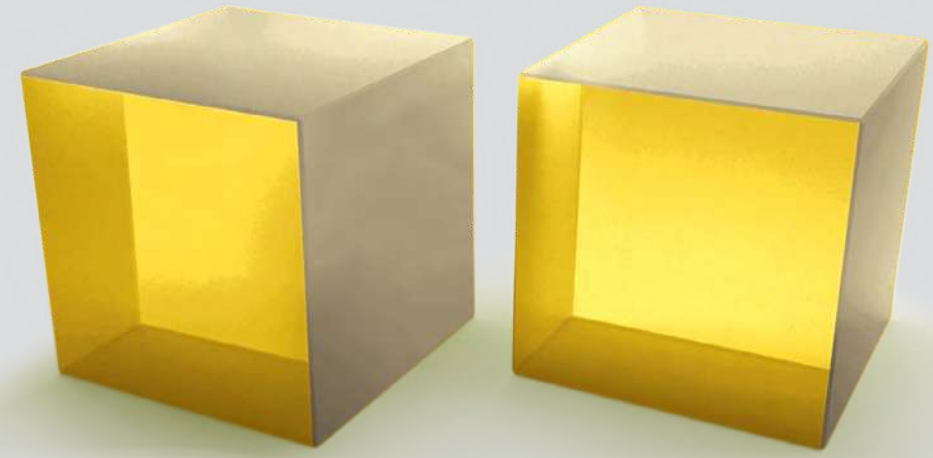
- Far infrared wavelength radiation generation by DFG, OPO methods
- Material for infrared optical elements: substrates, polarizers, waveplates, etc.

Optogama does not provide standard product list. Please contact us for solutions and pricing.

Cadmium selenide (CdSe) crystals feature an infrared transmission up to 24 μm, reasonably large nonlinearity and small walk-off angle. CdSe crystals can be employed into difference frequency generation (DFG), optical parametric oscillation (OPO) schemes to generate infrared laser radiation above ZGP absorption edge (>12 μm). For instance, CdSe OPO can potentially be pumped by 2 μm Tm-doped, Ho-doped, Tm and Ho co-doped lasers and produce far infrared idler radiation. Besides nonlinear optic applications cadmium selenide crystal material can be used for IR optical elements: substrates, polarizers, waveplates and other.

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	CdSe
Crystal structure	Hexagonal, 6mm
Lattice parameters	a = 4,2985 Å, c = 7,0150 Å
Optical symmetry	Positive uniaxial ($n_o > n_e$)
Density@288 K	5,81 g/cm^3
Mohs hardness	3,25
Transparency range	0,7-24 μm @"0" transmittance level)
Dispersion equations @T = 293 K (λ in μm)	$n_o^2 = 4{,}2243 + 1{,}7680\,\lambda^2/(\lambda^2 - 0{,}2270) + 3{,}1200\,\lambda^2/(\lambda^2 - 3380)$; $n_e^2 = 4{,}2009 + 1{,}8875\,\lambda^2/(\lambda^2 - 0{,}2171) + 3{,}6461\,\lambda^2/(\lambda^2 - 3629)$
Refractive indices	n_o = 2,431, n_e = 2,452@10,0 μm
Thermal conductivity @T = 293 K	6,9 (||c) Wm^{-1}K^{-1}, 6,2 (⊥c) Wm-1K^{-1}
Laser induced damage threshold	60 MW/cm^2@10,6 μm, 200 ns



$AgGaS_2$ crystals

Main features

- Unique non-linear properties across the transmission range from 0,5 µm to 12 µm
- Low optical absorption and scattering
- Transparency at short wavelengths

Application examples

- Frequency mixing in the middle IR region up to ~12 µm
- Second harmonic generation and up-conversion for CO_2 lasers
- Tunable OPO for solid-state lasers

Silver Thiogallate ($AgGaS_2$, AGS) has been demonstrated as an efficient crystal for nonlinear parametric applications in the infrared spectral range. Its transparency region spans from 0,53 µm to 12 µm. AGS based optical parametric oscillators feature continuously tunable radiation over a wide range of wavelengths in the infrared spectral range. High transparency in the short wavelength range beginning at 550 nm is used in OPOs pumped by Nd:YAG laser.
Using 2050 nm pump laser, an optimally designed $AgGaS_2$ OPO is tunable from about 2.5 to 12.0 µm. The output range can be extended b y the sum or difference frequency mixing (SFM/DFM). AGS crystal features high non-linear coefficient, high damage threshold, low optical absorption and scattering.

Standard specifications

$AgGaS_2$ CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>80%
Face dimensions tolerance	+0,0/-0,2 mm
Parallelism error	<30 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,2 mm at 45°
Surface quality	60-40 S-D
Coatings	BBAR/BBAR@1,2-2,6 µm/2,6-11 µm
Mount	Unmounted

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$AgGaS_2$
Crystal structure	Tetragonal, 42m
Lattice parameters	a = 5,742 Å, c = 10,26 Å
Optical symmetry	Negative uniaxial ($n_o > n_e$, λ<0,497 µm $n_e > n_o$)
Density	4,58 g/cm^3
Mohs hardness	3-3,5
Transparency range	0,47 - 13 µm @"0" transmittance level
Sellmeier equations @T = 293 K (λ in µm)	$n_o^2 = 5{,}79419 + 0{,}23114/(\lambda^2 - 0{,}06882) - 2{,}4534 \times 10^{-3}\lambda^2 + 3{,}1814 \times 10^{-7}\lambda^4 - 9{,}7051 \times 10^{-9}\lambda^6$; $n_e^2 = 5{,}54120 + 0{,}22041/(\lambda^2 - 0{,}09824) - 2{,}5240 \times 10^{-3}\lambda^2 + 3{,}6214 \times 10^{-7}\lambda^4 - 8{,}3605 \times 10^{-9}\lambda^6$
Refractive indices	n_o = 2,3471; n_e = 2,2914 @ 10,6321 µm
Thermal conductivity	1,4 (||c) Wm^{-1}K^{-1}, 1,5 (⊥c) Wm^{-1}K^{-1}

Guidance

Optogama provides guidance and theoretical calculations for particular $AgGaS_2$ applications. Contact us and we will help you to configure your crystal.

Standard products

FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
5 x 5 mm	1 mm	39°	45°	BBAR/BBAR@1,2-2,6/2,6-11 µm	DFG@1,2-2,6 µm, type I	7356
8 x 8 mm	1 mm	39°	45°	BBAR/BBAR@1,2-2,6/2,6-11 µm	DFG@1,2-2,6 µm, type I	7395
6 x 6 mm	2 mm	50°	0°	BBAR/BBAR@1,2-2,6/2,6-11 µm	DFG@1,2-2,6 µm, type II	7396
8 x 8 mm	2 mm	50°	0°	BBAR/BBAR@1,2-2,6/2,6-11 µm	DFG@1,2-2,6 µm, type II	7397

$AgGaSe_2$ crystals

Main features

- Excellent properties across the transmission range from 0,73 to 18 µm
- Low optical absorption and scattering
- High FOM (figure of merit) for non-linear interactions in NIR and MIR

Application examples

- Frequency mixing in the IR region ~18,3 µm
- Second harmonic generation and up-conversion for CO_2 lasers
- Tunable OPO for solid-state lasers

Silver gallium selenide ($AgGaSe_2$, AGSe) is an optically negative uniaxial crystal with a reasonable transmittance over ~0,7 µm - 18 µm region. AGSe crystals have proven to be used in nonlinear parametric downconversion (difference frequency generation, DGF) in the Mid-IR range by tandem with commercially available synchronously-pumped optical parametric oscillators (SPOPOs) in the femtosecond and picosecond regime. AGSe crystal has high figure of merit (~70 pm^2/V^2, n~2,6), which is six times larger than counterpart AGS. For some reasons AGSe is also a better choice over other mid-IR crystals. For example, even though GaSe has higher nonlinearity and comparable transparency region, AGSe has lower spatial walk-off and availability to be processed for particular application (growth and cut direction, dielectric thin-film coatings). ZGP has higher figure of merit, but its transparency region (~2-12 µm) is no match to AGSe.

Standard specifications

AgGaSe2 CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>80%
Face dimensions tolerance	+0,0/-0,2 mm
Parallelism error	<30 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,2 mm at 45°
Surface quality	60-40 S-D
Coatings	BBAR/BBAR@1,7-2,7 µm/5-18 µm
Mount	Unmounted

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$AgGaSe_2$
Crystal structure	Tetragonal, 42m
Lattice parameters	a = 5,9920 Å, c = 10,8803 Å
Optical symmetry	Negative uniaxial ($n_o > n_e$, λ<804 nm, $n_e > n_o$)
Density	5,7 g/cm^3
Mohs hardness	3-3,5
Transparency range	0,71 - 19 µm @"0" transmittance level
Sellmeier equations @T=293 K (λ in µm)	n_o^2=6,8507 + 0,4297/(λ^2 - 0,1584) - 0,00125 λ^2; n_e^2 = 6,6792 + 0,4598/(λ^2 - 0,2122) - 0,00126 λ^2
Refractive indices	n_o = 2,5917; n_e = 2,5585 @10,5 µm
Thermal conductivity @T = 293 K	1 (||c) $Wm^{-1}K^{-1}$, 1,1 (⊥c) $Wm^{-1}K^{-1}$
Laser induced damage threshold	>10 MW/cm^2@10,6 µm, 150 ns

Guidance

Optogama provides guidance and theoretical calculations for particular $AgGaSe_2$ applications. Contact us and we will help you to configure your crystal.

Standard products

FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
5 x 5 mm	2 mm	52°	45°	BBAR@1,7-2,7 µm/BBAR@5-18 µm	Ultrashort pulse DFG@1,7-2,7 µm -> ~5-18 µm, type I	15806
	5 mm	52°	45°	BBAR@1,7-2,7 µm/BBAR@5-18 µm	Ultrashort pulse DFG@1,7-2,7 µm -> ~5-18 µm, type I	15807
	10 mm	52°	45°	BBAR@1,7-2,7 µm/BBAR@5-18 µm	Ultrashort pulse DFG@1,7-2,7 µm -> ~5-18 µm, type I	15805

$ZnGeP_2$ crystals

Main features

- The transmission range spans from 0,74 µm to 12 µm
- High nonlinearity (75 pm/V)
- High thermal conductivity (35 W/mK)
- Nominal absorption coefficient <0,04 cm^{-1} at ~2,1 µm for o-wave

Application examples

- Mid-IR OPOs pumped at ~2,1 µm
- Generation of terahertz range frequencies

Zinc Germanium Phosphide (ZnGeP2, ZGP) crystals feature a combination of high nonlinearity, high thermal conductivity and a wide transmission range from 0,74 to 12 µm. These crystals gained credit for their role of ~2,1 µm pumped optical parametric oscillators (OPOs) spanning the spectral range from 2 to 8 µm.

Standard specifications

$ZnGeP_2$ CRYSTALS	
Orientation accuracy	<30 arcmin
Clear aperture	>80%
Face dimensions tolerance	+0,0/-0,2 mm
Length tolerance	+1,0/-0,0 mm
Parallelism error	<30 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,2 mm at 45°
Surface quality	60-40 S-D
Surface flatness	λ/4@632,8 nm
Coatings	Antireflective coatings @2,1 µm + 3,5-5 µm on both sides
Nominal absorption coefficient	≤0,04 cm^{-1}@2,1 µm, o-wave
Mount	Unmounted

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$ZnGeP_2$
Crystal structure	Tetragonal, 42m
Lattice parameters	a = 5,465 Å, c = 10,708 Å
Optical symmetry	Positive uniaxial ($n_e > n_o$)
Density	4,162 g/cm^3
Mohs hardness	5,5
Transparency range	0,74 - 12 µm @"0" transmittance level
Dispersion equations @1,5 - 10,59 µm range, T = 293 K (λ in µm)	n_o^2 = 11,6413 + 0,69363/(λ² - 0,21967) + 1586,06/(λ² - 832,75); n_e^2 = 12,1438 + 0,75255/(λ² - 0,21913) + 2061,68/(λ² - 951,07)
Refractive indices	n_o = 3,0738; n_e = 3,1137 @10,5 µm
Thermal conductivity @T = 293 K	36 (||c) $Wm^{-1}K^{-1}$, 35 (⊥c) $Wm\text{-}1K^{-1}$
Laser induced damage threshold	60 MW/cm^2@10,6 µm, 100 ns

Guidance

Optogama provides guidance and theoretical calculations for particular $ZnGeP_2$ applications. Contact us and we will help you to configure your crystal.

Standard products

FACE DIMENSIONS	LENGTH	THETA	PHI	COATINGS	APPLICATION	SKU
5 x 5 mm	10 mm	55,3°	0°	AR@2,1 µm + BBAR@3,5-5 µm	MWIR generation, type I, eeo interaction	15358
	15 mm	55,3°	0°	AR@2,1 µm + BBAR@3,5-5 µm	MWIR generation, type I, eeo interaction	15359
	20 mm	55,3°	0°	AR@2,1 µm + BBAR@3,5-5 µm	MWIR generation, type I, eeo interaction	15360

GaSe crystals

Main features

- Broad transparency range from 0,65 µm to 18 µm
- Large nonlinearity and birefringence
- Soft and cleaves along [001] plane
- Cannot be cut and polished at certain angles
- Comes uncoated and mounted for proper handling

Application examples

- Broadband mid-IR difference frequency generation
- Second harmonic (SH) of CO_2, CO, dye lasers
- Terahertz (THz) generation by optical rectification
- Terahertz detectors for terahertz time domain spectroscopy (THz-TDS)

Optogama offer z-cut, cleaved surface and mounted gallium selenide (GaSe) crystals. Custom clear apertures and crystal thicknesses from tens of microns up to several millimeters are available upon request. Due to fragile nature of GaSe it is not possible to apply antireflection coatings.

Standard specifications

GaSe crystals	
Clear aperture	≥ ø7 mm or custom
Surface quality	Cleaved surfaces
Coatings	Uncoated, unavailable
Mount	ø25,4 mm black anodized aluminum mount

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	GaSe
Crystal structure	Hexagonal, -62m
Lattice parameters	A = 3,742 Å, c = 15,918 Å
Optical symmetry	Negative uniaxial (no>ne)
Density	5,03 g/cm^3
Mohs hardness	≈ 0
Transparency range	0,62-20 µm @ "0" transmittance level
Sellmeir equations	$n_o^2 = 7{,}443 + 0{,}4050/\lambda^2 + 0{,}0186/\lambda^4 + 0{,}0061/\lambda^6 + 3{,}1485\,\lambda^2/(\lambda^2 - 2194)$; $n_e^2 = 5{,}76 + 0{,}3879/\lambda^2 - 0{,}2288/\lambda^4 + 0{,}1223/\lambda^6 + 1{,}8550\,\lambda^2/(\lambda^2 - 1780)$
Refractive indices	n_o = 2,8158; n_e = 2,4392 @10,6 µm

Guidance

Optogama provides guidance and theoretical calculations for particular GaSe applications. Contact us and we will help you to configure your crystal.

Standard products

CLEAR APERTURE	LENGTH	ORIENTATION	COATINGS	SKU
≥ ø7 mm	0,2 mm	z-cut	Uncoated	31313
	0,5 mm	z-cut	Uncoated	31124
	1 mm	z-cut	Uncoated	31126
	2 mm	z-cut	Uncoated	31127

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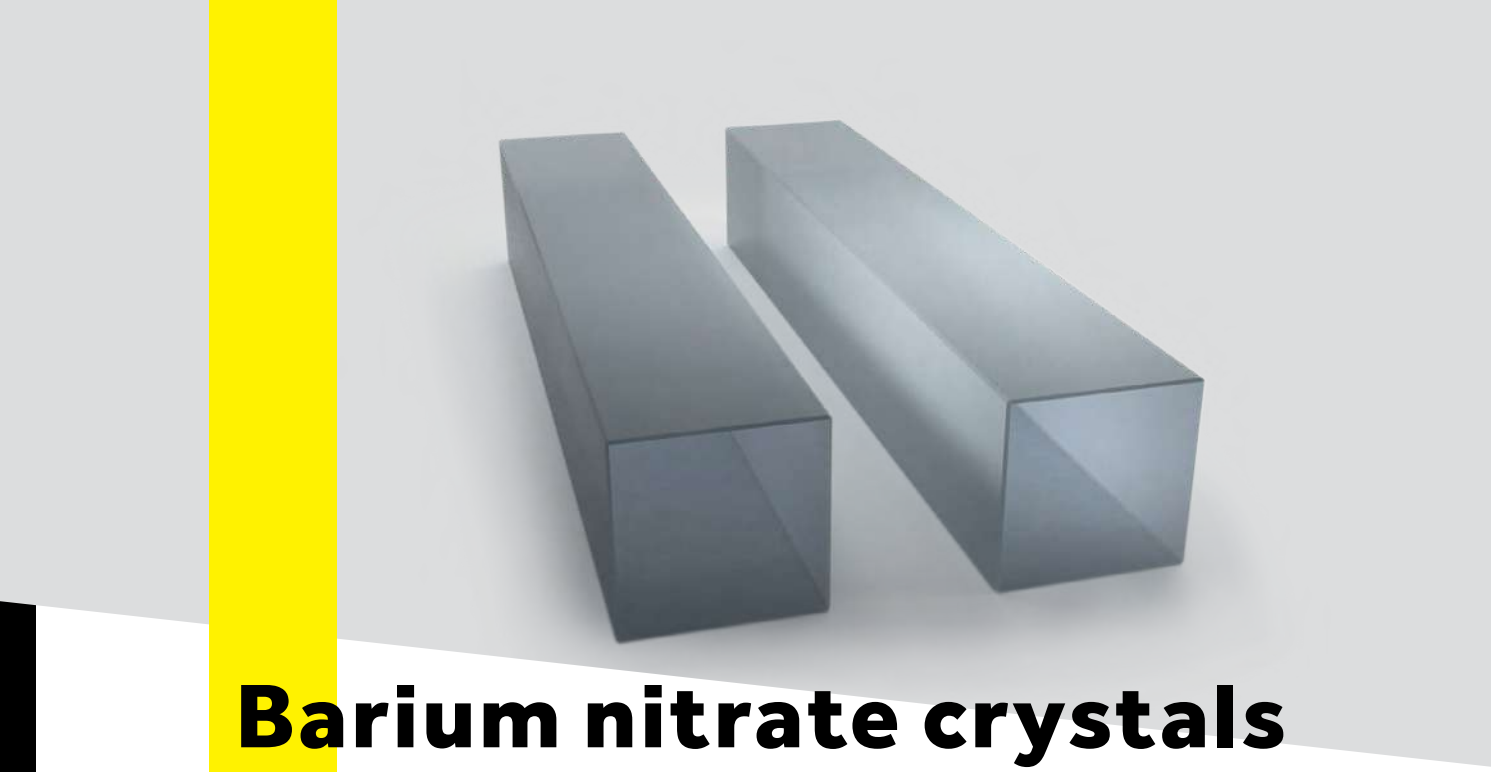
Barium nitrate crystals

KGW crystals

KYW crystals



Barium nitrate crystals

Main features

- Transparency range from 350 nm to 1800 nm
- Raman frequency shift of 1048 cm^{-1}
- Excellent Raman shifter for nanosecond applications
- Custom crystal dimensions and coatings available upon request

Application examples

- External cavity Raman laser pumped by commercially available passively Q-switched nanosecond Nd:YAG laser
- Generation of 1,59 µm "eye-safe" radiation, which coincides with CO_2 absorption line

Barium nitrate ($Ba(NO_3)_2$) is one of the leading crystals among solid-state Raman shifters in terms of Raman gain coefficient, which is known to be the highest at nanosecond steady-state regime (g_R = 47 cm/GW@532 nm pump). Barium nitrate also features a moderately broad transparency range (0,33 µm - 1,8 µm) and high damage threshold. Drawbacks of barium nitrate crystal are low thermal conductivity (1,17 $Wm^{-1}K^{-1}$) and high thermo-optic coefficient (dn/dT = -20 × $10^{-6}K^{-1}$), which lead to the thermal lensing effect. The crystal is soft and hygroscopic, therefore should be treated with caution. Optogama recommend using barium nitrate as a Raman shifter for nanosecond applications.

Standard specifications

BARIUM NITRATE CRYSTALS	
Orientation	[110]
Clear aperture	>85%
Face dimensions tolerance	±0,5 mm
Length tolerance	±1 mm
Parallelism error	<5 arcmin
Perpendicularity error	<10 arcmin
Protective chamfers	<0,25 mm at 45°
Surface quality	40-20 S-D
Surface flatness	<λ /4@632,8 nm
Coatings	AR/AR@500-700 nm
Laser induced damage threshold	>10 J/cm^2@1064 nm, 10 ns
Mount	Unmounted

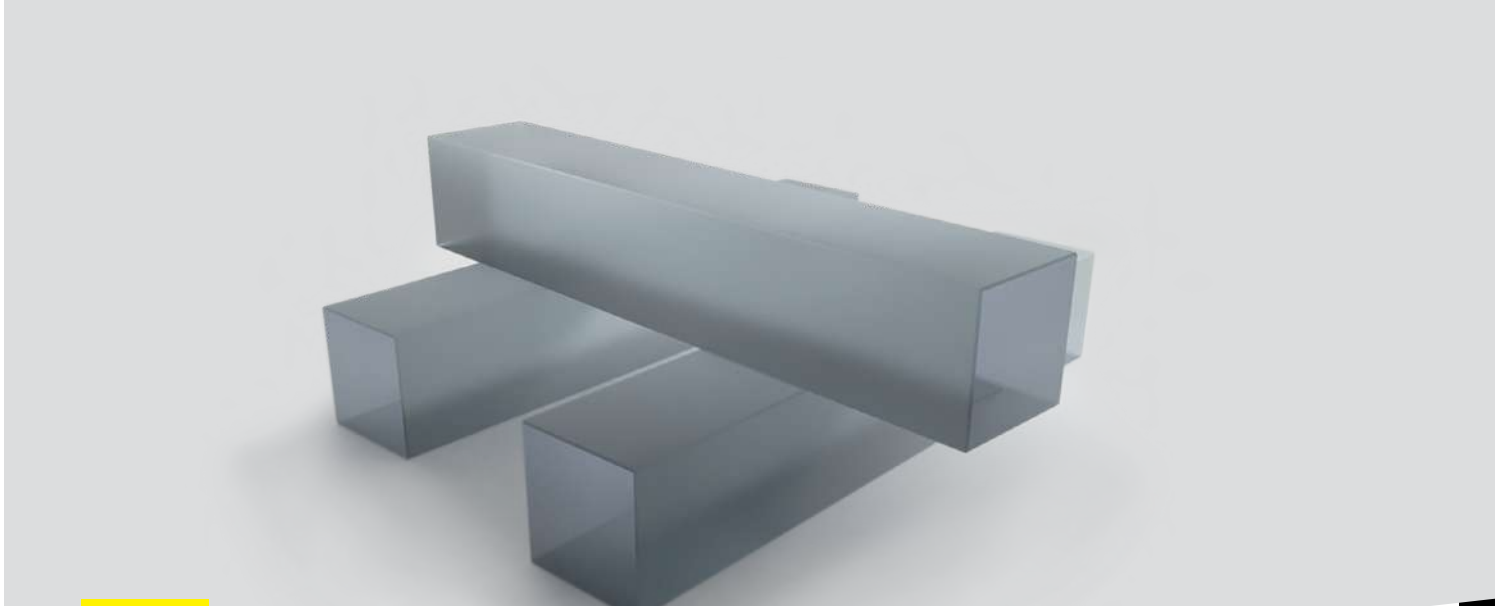
Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$Ba(NO_3)_2$
Crystal structure	Cubic, $P2_13$
Lattice parameters	a = b = c = 8,11 Å
Density	3,25 g/cm^3
Mohs hardness	2,5-3
Transparency range	0,33 µm - 1,8 µm
Refractive index	1,555@1064 nm
Thermal conductivity	1,17 $Wm^{-1}K^{-1}$@||c
Thermal expansion coefficient	$13×10^{-6}$ 1 $°C^{-1}$
dn/dT	$-20×10^{-6}K^{-1}$
Raman frequency shift	1047 cm^{-1}
Raman linewidth	0,4 cm^{-1}
Raman gain (ns, steady-state regime)	47 cm/GW@532 nm 11 cm/GW@1064 nm
Dephasing time	28 ps

Standard products

FACE DIMENSIONS	LENGTH	COATINGS	SKU
5 x 5 mm	15 mm	AR/AR@500-700 nm	28479
	30 mm	AR/AR@500-700 nm	28480
	45 mm	AR/AR@500-700 nm	28481
8 x 8 mm	75 mm	AR/AR@500-700 nm	28482

Minimum order quantity: 2 pieces.



KGW crystals

Main features

- Broad transparency range from 300 nm to 5 µm
- Two pump polarization-dependent Raman shifts at 768 cm^{-1} and 901 cm^{-1}
- Excellent Raman shifter for picosecond applications
- Custom dimensions, orientation, and coatings available upon request

Application examples

- Raman generator pumped by commercially available picosecond Nd:YAG laser

Potassium gadolinium tungstate ($KGd(WO_4)_2$, KGW) crystals feature good mechanical properties, relatively good thermal conductivity (2,5-3,4 $Wm^{-1}K^{-1}$) and wide transparency range, which spans from 350 nm to 5 µm. KGW as a Raman crystal features two large Raman modes at 768 cm^{-1} and 901 cm^{-1}, which are pump polarization dependent. Optogama recommend using KGW crystal as a Raman shifter for picosecond applications.

Standard specifications

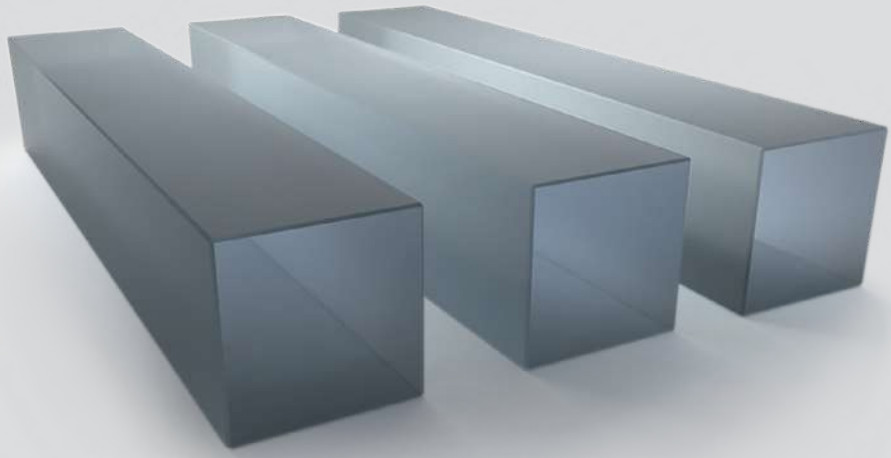
KGW CRYSTALS	
Orientation	b-cut
Clear aperture	>90%
Face dimensions tolerance	+0,0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	<λ/4@632,8 nm
Coatings	AR(R<0,7%)@500-650 nm
Laser induced damage threshold	>10 J/cm^2@1064 nm, 10 ns
Mount	Unmounted

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$KGd(WO_4)_2$
Crystal structure	Monoclinic, C2c
Lattice parameters	a = 10,652(4) Å, b = 10,374(6) Å, c = 7,582(2) Å
Density	7,27 g/cm^3
Mohs hardness	4-5
Transparency range	0,3 µm - 5 µm
Refractive indices@1064 nm	n_p = 1,982 n_m = 2,010 n_g = 2,061
Thermal conductivity	K_a = 2,6 $Wm^{-1}K^{-1}$ K_b = 3,8 $Wm^{-1}K^{-1}$ K_c = 3,4 $Wm^{-1}K^{-1}$
dn/dT	dn_p/dT = -15,7×$10^{-6}K^{-1}$ dn_m/dT = -11,8×$10^{-6}K^{-1}$ dn_g/dT = -17,3×$10^{-6}K^{-1}$
Raman frequency shift	901 cm^{-1} (p[mm]p), 767 cm^{-1} (p[gg]p)
Raman linewidth	5,4 cm^{-1}@901 cm^{-1} (p[mm]p) 6,4 cm^{-1}@767 cm^{-1} (p[gg]p)
Raman gain (ps, transient-state regime)	11 cm/GW@532 nm 3 cm/GW@1064 nm
Dephasing time	2 ps

Standard products

FACE DIMENSIONS	LENGTH	COATINGS	SKU
5 x 5 mm	15 mm	Uncoated	7259
		AR/AR@450-800 nm	7262
	30 mm	Uncoated	7260
		AR/AR@450-800 nm	7263
	45 mm	Uncoated	7261
		AR/AR@450-800 nm	7264
	50 mm	Uncoated	22033
		AR/AR@450-800 nm	11429



KYW crystals

Main features

- Broad transparency range from 350 nm to 5,5 µm
- Two large Raman shifts of 765 cm^{-1} and 905 cm^{-1}

Application examples

- Raman lasers
- Radiation frequency tuning

Potassium yttrium tungstate ($KY(WO_4)_2$, KYW) crystals offer two strong phonon modes around 765 cm^{-1} and 905 cm^{-1}, which have similar Raman gain and are pump polarization dependent. KYW crystals possess good mechanical properties, high optical damage threshold, broad transparency range (350 nm - 5,5 µm) and thermal conductivity around three times higher than barium nitrate.

Standard specifications

KYW CRYSTALS	
Orientation	b-cut
Clear aperture	>90%
Face dimensions tolerance	+0/-0,1 mm
Length tolerance	±0,1 mm
Parallelism error	<20 arcsec
Perpendicularity error	<10 arcmin
Protective chamfers	<0,1 mm at 45°
Surface quality	10-5 S-D
Surface flatness	<λ/8@632,8 nm
Wavefront distortion	<λ/4@632,8 nm
Coatings	AR(R<0,7%)@500-650 nm
Laser induced damage threshold	>10 J/cm^2@1064 nm, 10 ns
Mount	Unmounted

Properties

PHYSICAL AND OPTICAL PROPERTIES	
Chemical formula	$KY(WO_4)_2$
Crystal structure	Monoclinic, C2/c
Lattice parameters	a = 10,64 Å, b = 10,32 Å, c = 7,55 Å
Density	6,61 g/cm^3
Mohs hardness	4-5
Transparency range	0,35-5,5 µm
Refractive indices (1064 nm, room temperature)	n_p = 1,9688 n_m = 2,0065 n_g = 2,0507
Thermal conductivity (average value)	3,3 $Wm^{-1}K^{-1}$
dn/dT	dn_p/dT = -14,6×10^{-6} K^{-1} dn_m/dT = -8,9×10^{-6} K^{-1} dn_g/dT = -12,4×10^{-6} K^{-1}
Raman frequency shift (T = 300 K)	905 cm^{-1} (E||N_m) 765 cm^{-1} (E||N_g)
Raman gain (1064 nm pump, steady-state regime)	3,6 cm/GW

Standard products

FACE DIMENSIONS	LENGTH	COATINGS	SKU
5 x 5 mm	15 mm	Uncoated	7273
		AR/AR@450-800 nm	7276
	30 mm	Uncoated	7274
		AR/AR@450-800 nm	7277
	45 mm	Uncoated	7275
		AR/AR@450-800 nm	7278
	50 mm	Uncoated	31051
		AR/AR@450-800 nm	31052

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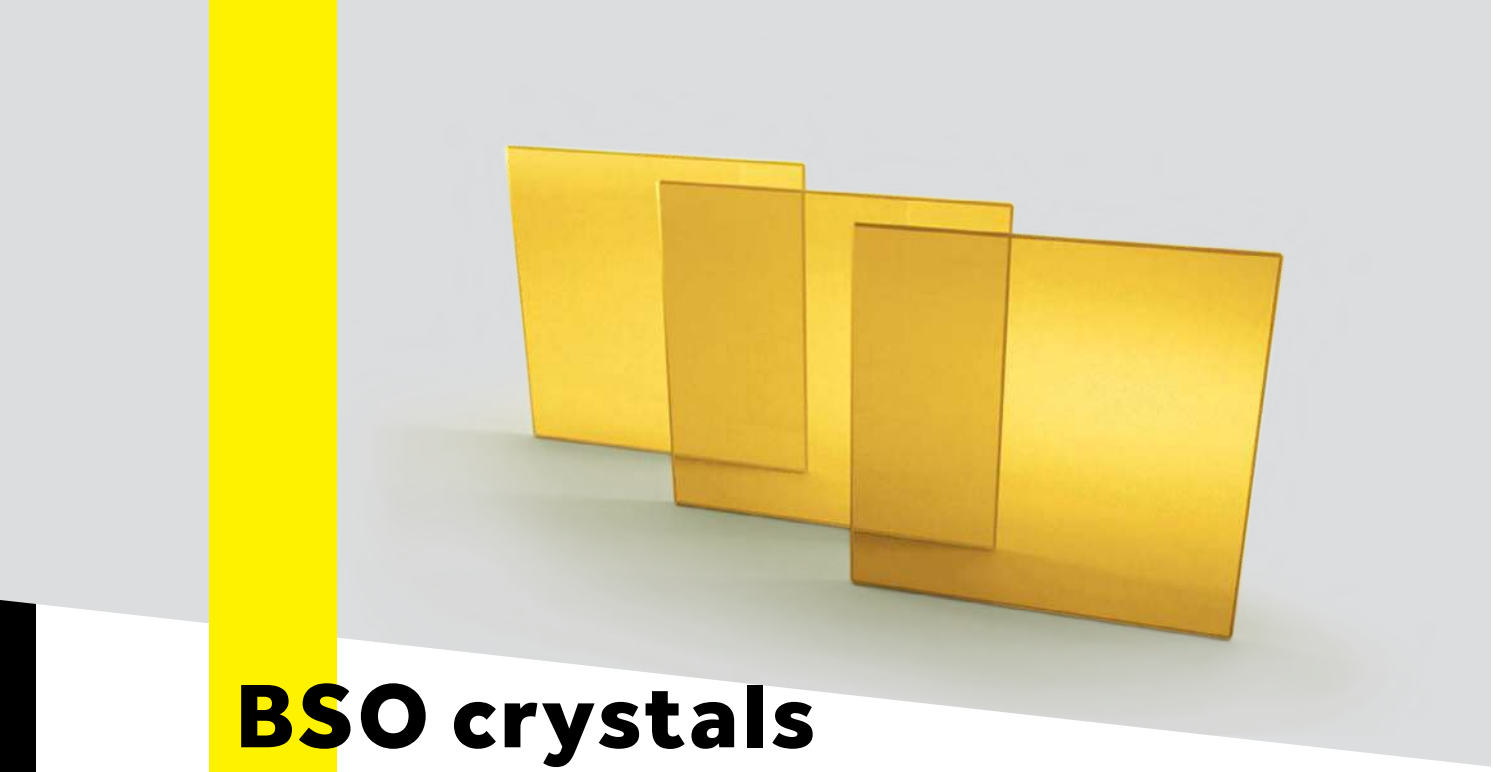
BSO crystals

Fe:$LiNbO_3$ crystals

SBN crystals

BGO crystals



BSO crystals

Main features

- High electro-optic coefficient (r_{41} = 5 pm/V)
- High phase-conjugation efficiency
- Available in large size elements or wafers up to 3"
- Customization available upon request

Application examples

- Spatial light modulators
- Optical switches
- Pockels readout optical memory (PROM) applications
- Optical waveguides

Bismuth silicone oxide ($Bi_{12}SiO_{20}$, BSO) crystals are highly efficient photoconductors with a low dark conductivity, that allows a build-up of large photo-induced space-charges. Tremendous photoconductivity and electro-optic properties make BSO crystals attractive in a range of applications: spatial light modulators, optical switches, phase conjugation mixers. BSO crystals are grown by modified Czochralski method and available in up to 3'' diameter aperture size. Crystals can be supplied with ITO coatings on request.

Standard specifications

BSO CRYSTALS	
Clear aperture	85%
Face dimensions tolerance	+0.1/-0,25 mm
Thickness tolerance	±0,2 mm
Parallelism error	<30 arcsec
Protective chamfers	<0,3 mm at 45°
Surface quality	40-20 S-D
Wavefront distortion	<λ/4@632,8 nm
Coatings	Uncoated
Mount	Unmounted

Properties

MAIN PROPERTIES	
Chemical formula	$Bi_{12}SiO_{20}$
Crystal structure	Cubic, point group 23
Lattice parameters	10,10 Å
Density	9,2 g/cm^3
Mohs hardness	5
Transmission Range	0,45-6 µm
Refractive Index	2,54@0,63 µm
Optical Activity	42 deg/mm@500 nm
Electro-optic coefficient	r_{41} = 5 pm/V
Dielectric constant (low frequency)	56
Dark resistance	10^{14} Ohm cm

Standard products

FACE DIMENSIONS	LENGTH	ORIENTATION	SKU
5 x 5 mm	5 mm	[100]	6885
	5 mm	[110]	6884
10 x 10 mm	5 mm	[100]	6883
	5 mm	[110]	6882
20 x 20 mm	1,1 mm	[100]	6881
	1,1 mm	[110]	6880
25 x 25 mm	1,1 mm	[110]	27782
30 x 30 mm	1,1 mm	[110]	1558
	1,4 mm	[110]	9095

BGO crystals

Main features

- High electro-optic coefficient (r_{41} = 3,5 pm/V)
- Low dark conductivity
- Large size elements or wafers up to 3"
- Customization available upon request

Application examples

- Spatial light modulators
- Optical switches
- Optical correlators

Bismuth germanite ($Bi_{12}GeO_{20}$, BGO) crystals are highly efficient photoconductors with a low dark conductivity, that allows a build-up of large photo-induced space-charges. Tremendous photoconductivity and electro-optic properties make BSO crystals attractive in a range of applications: spatial light modulators, optical switches, phase conjugation mixers. BSO crystals are grown by modified Czochralski method and available in up to 3" diameter aperture size. Crystals can be supplied with ITO coatings on request.

Standard specifications

BGO CRYSTALS	
Clear aperture	85%
Face dimensions tolerance	+0.1/-0,25 mm
Thickness tolerance	±0,2 mm
Parallelism error	<30 arcsec
Protective chamfers	<0,3 mm at 45°
Surface quality	40-20 S-D
Wavefront distortion	<λ/4@632,8 nm
Coatings	Uncoated
Mount	Unmounted

Properties

MAIN PROPERTIES	
Chemical formula	$Bi_{12}GeO_{20}$
Crystal structure	Cubic, point group 23
Lattice parameters	10,15 Å
Density	9,2 g/cm³
Transmission Range	0,45-7 µm
Refractive Index @0.63µm	2,55
Optical Activity @500 nm	41,5 deg/mm
Electro-Optic Coefficient r_{41}	3,5 pm/V
Dielectric constant	40
Dark Resistance	10^{14} Ohm cm

Standard products

FACE DIMENSIONS	LENGTH	ORIENTATION	SKU
20 x 20 mm	1,1 mm	[100]	6875
	1,1 mm	[110]	6874
25 x 25 mm	1,1 mm	[110]	31146
30 x 30 mm	1,1 mm	[110]	6876
	1,4 mm	[110]	6877

Fe:$LiNbO_3$ crystals

Main features

- High electro-optic coefficient (r_{41} = 5 pm/V)
- High phase conjugation efficiency
- Available in large size elements or wafers up to 3"
- Customization available upon request

Application examples

- Spatial light modulators
- Optical switches
- Holographic recording
- Optical waveguides

Lithium niobate ($LiNbO_3$, LN) crystal doped with iron (Fe:$LiNbO_3$) is an attractive photorefractive material, due to the high photorefractive sensitivity, high electro-optic coefficients and diffraction efficiency, chemo-mechanical properties. Fe:$LiNbO_3$ crystals are grown by Czochralsky method and available in large size. Wide range of available dopants and levels enable to adjust material properties for particular applications. What is more, Fe:$LiNbO_3$ crystals are easy to handle, low cost, therefore suitable for volume production.

Standard specifications

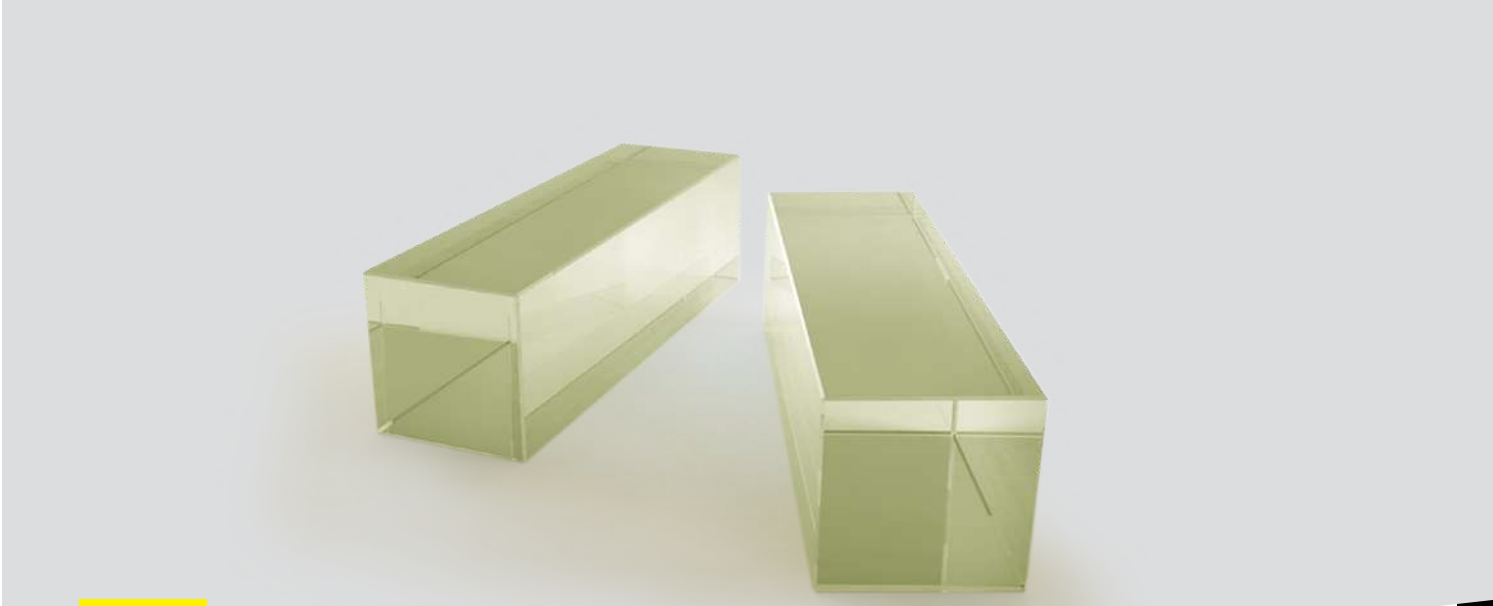
FE:$LINBO_3$ CRYSTALS	
Dopant level, Fe_2O_3	0,02 mol. % 0,03 mol. % 0,05 mol. % 0,1 mol. %
Orientation	90° cut (X-cut, Y-cut)
Clear aperture	85%
Face dimensions tolerance	+0/-0,2 mm
Thickness tolerance	±0,2 mm
Parallelism error	<3 arcmin
Protective chamfers	<0,3 mm at 45°
Surface quality	20-10 S-D
Wavefront distortion	<λ/4@632,8 nm
Coatings	None, antireflective or indium tin oxide coatings available upon request
Electrodes	None, available upon request
Mount	Unmounted

Properties

MAIN PROPERTIES	
Chemical formula	Fe:$LiNbO_3$
Crystal structure	Trigonal, 3m
Density	4,64 g/cm^3
Mohs hardness	5
Transmission range	0,35-5,5 µm
Refractive index @0.63 µm	n_e = 2,20 n_o = 2,29
Electro-optic coefficients	r_{22} = 6,8 pm/V r_{31} = 10 pm/V r_{33} = 32 pm/V
Dielectric constant	e_{11} = 85 e_{33} = 30

Standard products

FACE DIMENSIONS	LENGTH	DOPING	SKU
10 x 10 mm	1 mm	0,02 % Fe_2O_3	7006
		0,03 % Fe_2O_3	7007
		0,05 % Fe_2O_3	7008
		0,1 % Fe_2O_3	7009
	5 mm	0,02 % Fe_2O_3	6457
		0,03 % Fe_2O_3	6458
		0,05 % Fe_2O_3	4052
		0,1 % Fe_2O_3	7005
20 x 20 mm	1 mm	0,02 % Fe_2O_3	7010
		0,03 % Fe_2O_3	7011
		0,05 % Fe_2O_3	7012
		0,1 % Fe_2O_3	7013



SBN crystals

Main features

- Pure or doped with Ce
- Efficient phase-conjugation
- Custom size, doping level, unpoled, antireflective coated and electrodeless crystals are available upon request

Application examples

- Optical information recording
- Pyroelectrical detectors
- Self-pumped self-conjugation mirror
- Optical correlators

Strontium-barium niobate ($Sr_xBa_{(1-x)}Nb_2O_6$, SBN:x, x = 61) crystals feature excellent optical and photorefractive properties. They are available nominally pure or doped with Ce. Different composition SBN crystals found their application in electro-optics, acousto-optics, photorefractive, non-linear optics fields. Optogama provide inclusion-free and homogenous SBN crystals, which are grown by Modified Stepanov method and available with linear dimensions up to 40 mm.

Standard specifications

SBN:61 CRYSTALS	
Orientation	Short edge along tetragonal axis
Poling	Poled or unpoled
Electrodes	Carbon-water electrodes or no electrodes
Clear aperture	85%
Face dimensions tolerance	+0/-0,2 mm
Thickness tolerance	±0,2 mm
Parallelism error	<30 arcsec
Protective chamfers	<0,1 mm at 45°
Surface quality	40-20 S-D over clear aperture, 80-50 S-D other surfaces
Surface flatness	<λ/4@632,8 nm
Coatings	Uncoated
Mount	Unmounted

Properties

MAIN PROPERTIES	
Composition	SBN:61
Crystal structure	Tetragonal, 4 mm
Lattice parameters	a = 12,46 Å, c = 3,946 Å
Density	5,4 g/cm^3
Mohs hardness	5,5
Melting temperature	1480°C
Curie temperature	75°C
Transparency range	0,45-5,5 µm
Refractive index @633 nm	n_o = 2,3103 n_e = 2,2817
Δn @633 nm	-0,0286
Half-wave voltage (λ/2)	240 V
Dielectric constant, (T = 293 K)	900
Electro-optic coefficients	r_{13} = 45 pm/V r_{33} = 250 pm/V
Pyroelectric coefficient	0,065 µC cm^{-2} K^{-1}
Dielectric constant	880

Standard products

MATERIAL	FACE DIMENSIONS	LENGTH	DOPING	SKU
SBN:61	5 x 5 mm	5 mm	Undoped	73
			CeO2 0,002 wt, %	6940
			CeO2 0,01 wt, %	6944
		10 mm	Undoped	74
			CeO2 0,002 wt, %	6941
			CeO2 0,01 wt, %	6945
		15 mm	Undoped	75
			CeO2 0,002 wt, %	6942
			CeO2 0,01 wt, %	6946

Viewsitec 友思特

广州友思特科技有限公司

www.viewsitec.com
sales@viewsitec.com

广州市黄埔区开泰大道30号佳都PCI科技园6号楼

T (+86) 400 - 999 - 3848

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华东/华南区销售
(T: 181 2413 0753)

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